Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

February, 1936

Volume 110 *No. 2*

General:

C. & O. 4-8-4 Type Locomotives for Heavy Passenger Service 45
Equipment Orders in 1935 Fewer Than in 1934 ... 49
Annual Report of the Bureau of Locomotive Inspection 51
Turbine Locomotive Built by London, Midland & Scottish 53
Enginehouse Foreman Driven to Golf 57
Fusible Drop Plugs on Southern Pacific 58
Flanged Staybolt Holes on C. & O. 59

Editorials:

What Do You Want to Know? 60
Turbine Locomotive Given Another Chance 60
Alloy Steels and Light Weight 61
Romance of Electrical Development on Railroads .. 61
New Books 62

The Reader's Page:

Fitting Floating Rod Bushings 63
Plea for Separate Journal Boxes 63
And He Reads the *Railway Mechanical Engineer* .. 63
Romney, Hythe & Dymchurch Railway 63
Marinac vs. Mechanical Engineer 64
Which Comes First, the Job or the Rule? 64
What Would You Have Done? 64

Gleanings from the Editor's Mail 65

Car Foremen and Inspectors:

Port Huron Car Shop Kinks 66
Outfit for Handling Freon Containers 69
Latex Upholstery Material 70
Metal Spray Unit 70
Paint Cleaner and Protector 71
Portable Sandblast Machine 71
Portable Lubrication Cart 72
Decisions of Arbitration Cases 72

Back Shop and Enginehouse:

Labor Saving Devices at Albuquerque Shop 74
Taper Chaser Die Heads 76
From Seven to Seven 77
Repairing Pneumatic Drills at Pitcairn Shops 80
High Power Precision Surface Grinder 83
Diesel Engine Questions and Answers 84

Clubs and Associations 85

News 86

Index to Advertisers .... (Adv. Sec.) 22

Published on the first Thursday of each month

Simmons-Boardman Publishing Company

1309 Noble Street, Philadelphia, Pa. Editorial and Executive Offices, 30 Church Street, New York, N. Y., and 105 West Adams Street, Chicago, Ill.

Cleveland: Terminal Tower
Washington: 832 National Press Bldg.
San Francisco: 55 New Montgomery St.

Subscriptions, including 12 regular monthly issues, payable in advance and postage free. United States, U. S. possessions and Canada: 1 year, $3; 2 years, $5. Foreign countries: 1 year, $4; 2 years, $7.

The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service.

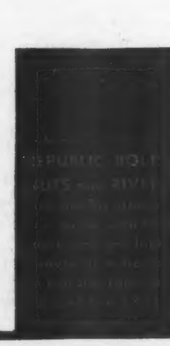
WHY THE TREND TOWARD ALLOY STEEL STAYBOLTS?

What with expansion and contraction of the firebox, not to mention the motion between the sheets, the staybolt job is tough for any material. » » » Corrosion and fatigue resistance is of prime importance, and here staybolts of Agathon Alloy Steel are supreme since they have the highest fatigue resistance of any staybolt material. » » » Since Agathon Alloy Steel is less affected by heating and forging temperatures it drives up solidly and stays in place longer. The added alloys keep grain size small, improve corrosion resistance and prevent embrittlement at the neck of the bolt—often a weak spot. These advantages of Agathon Alloy Steel staybolts explain why more and more railroads are standardizing on this superior staybolt material. » » »

REPUBLIC STEEL

Republic Steel
CORPORATION

ALLOY STEEL DIVISION, MASSILLON, OHIO
GENERAL OFFICES: CLEVELAND, OHIO



When writing in reference to this advertisement please address Dept. RG

Railway Mechanical Engineer

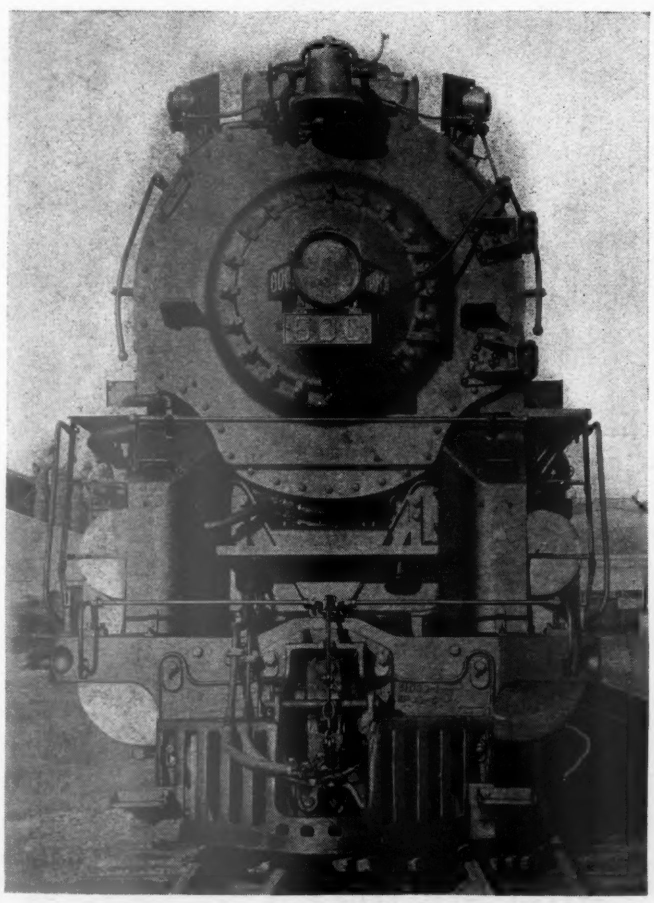
Founded in 1832 as the American Rail-Road Journal

February - 1936

C. & O. 4-8-4 Type Locomotives For Heavy Passenger Service

Another road adopts 4-8-4 type —Lima delivers five high-capacity locomotives for mountain grade operation

OF the few steam locomotives built in 1935 the five of the 4-8-4 type from the Lima Locomotive Works, Inc., for the Chesapeake & Ohio represent the outstanding design. These locomotives, which are the first with this wheel arrangement to be used on the C. & O., are numbered from 600 to 604, inclusive, and are known as the "Greenbrier" type, or Class J-3. In addition to being numbered each locomotive has been given the name of a person who formerly lived in the territory served by the road and whose fame is nation wide. The names of those chosen were Th. Jefferson, Patrick Henry, Benj. Harrison, James Madison and Ed. Randolph.



Front view of C. & O. 4-8-4 type locomotive showing drop coupler

The service for which these locomotives were designed is the handling of heavy through passenger trains on the main line between Hinton, W. Va., and Charlottesville, Va., a distance of 175 miles. Between these points the C. & O. passes over two ranges of the Allegheny Mountains and one range of the Blue Ridge Mountains. The maximum ruling grades over these ranges vary from 1.33 to 1.52 per cent and are from three to eight miles in length. The new locomotives are being used to supplement those of the present Class J-2, U. S. R. A. heavy 4-8-2 type, now in passenger service in this territory. They will haul such trains as the George Washington, the Sportsman and the F. F. V., all of which are composed of modern, all steel, air-conditioned Pullmans, day coaches and tavern-type diners.

These locomotives have the largest combined heating surface of any locomotive of this type thus far built; namely, 7,880 sq. ft. The high total and the relatively high percentage of radiant heating surface is relied upon to produce a heat transfer which, combined with care throughout the design to effect high economy in the utilization of steam in the cylinders, is expected to provide a locomotive capable of developing not less than 5,000 cylinder horsepower.

The Boiler

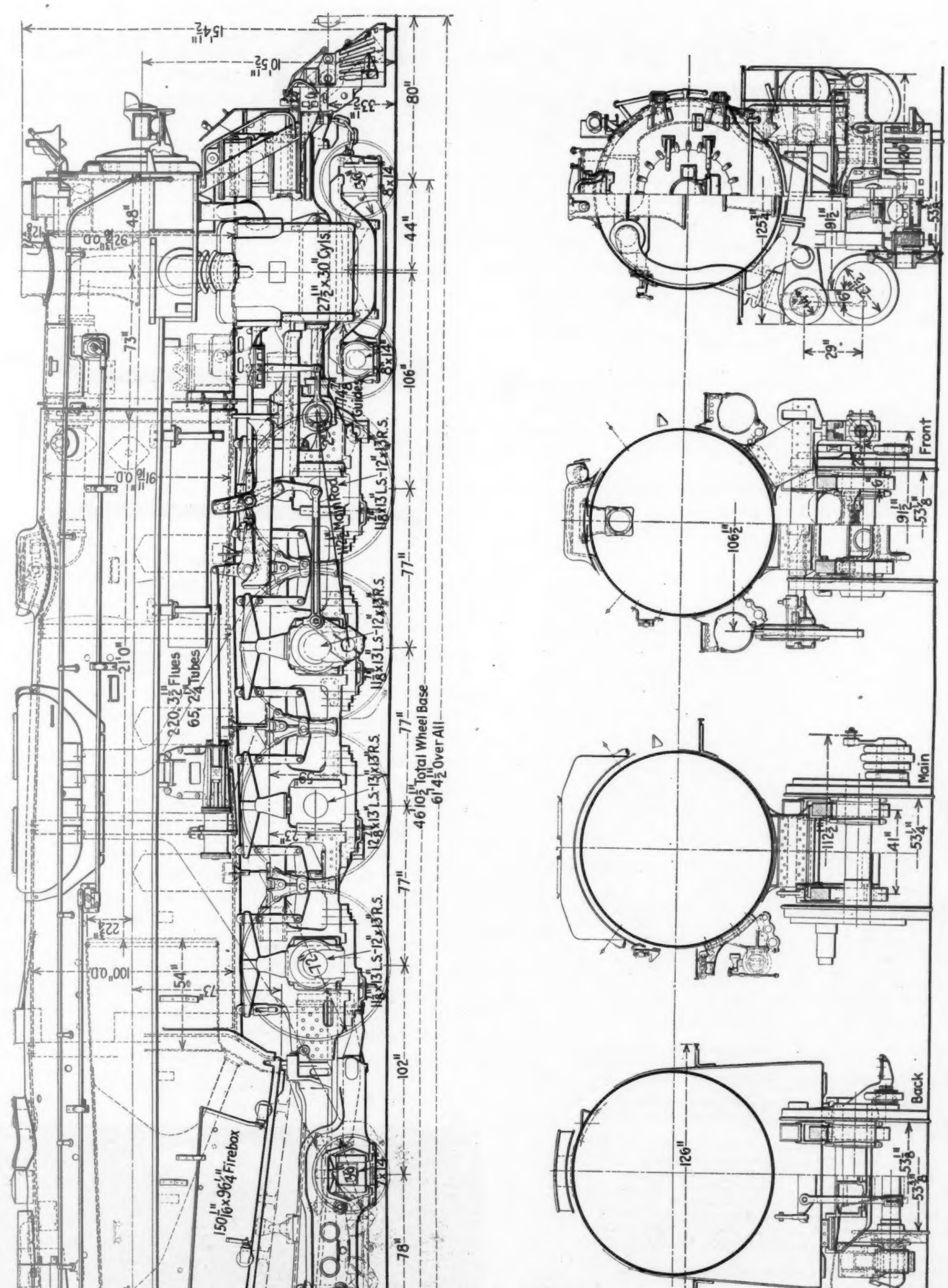
The boiler, which carries a pressure of 250 lb. per sq. in., but is designed for a maximum of 260 lb., is of unusually generous capacity and, using the Cook formula, has an estimated evaporative capacity of 79,640 lb. per hour, including an eight per cent allowance for the feedwater heater. In addition, the design provides the largest steam space possible within the clearance limit.

The shell, which is of the conical type, is made up of

Chesapeake & Ohio 4-8-4 type locomotive, Class J3, designed for heavy passenger traffic. Built by Lima Locomotive Works, Inc.

General dimensions, weights and proportions

Railroad	C. & O.
Builder	Lima Loco. Wks., Inc.
Type of locomotive	4-8-4
Number of locomotives	5
Road class	J-3
Road numbers	600-604
Date built	1935
Service	Passenger
Dimensions:	
Height to top of stack, ft. and in.	15-4½
Height to center of boiler, ft. and in.	10-5½
Width overall, in.	126
Cylinder centers, in.	91½
Weights in working order, lb.:	
On drivers	273,000
On front truck	89,500
On trailing truck	53,000 Front 61,000 Back
Total engine	477,000
Tender, loaded	381,700
Wheel bases, ft. and in.:	
Driving	19- 3
Rigid	12-10
Front truck, in.	88
Trailing truck, in.	78
Engine, total	46-10½
Engine and tender, total	98- 5¼
Wheels, diameter outside tires, in.:	
Driving	72
Front truck	36
Trailing truck	36 and 44
Engine:	
Cylinders, number, diameter and stroke, in.	2-27½ × 30
Valve gear, type	Walschaert
Valves, piston type, size, in.	14
Maximum travel, in.	7½
Steam lap, in.	1⁵⁄₁₆
Exhaust clearance, in.	³⁄₁₆
Lead, in.	¼
Cutoff in full gear, per cent	79.7
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	250
Diameter, first ring, outside in.	91¹¹⁄₁₆
Diameter, largest outside in.	100
Firebox, length, in.	150¹⁄₁₆
Firebox, width, in.	96¼
Height mud ring to crown sheet, back, in.	67½
Height mud ring to crown sheet, front, in.	95¾
Combustion chamber length, in.	54
Arch tubes, number and diameter, in.	2-3½
Thermic Syphons, number	2
Tubes, number and diameter, in.	65-2¼
Flues, number and diameter, in.	220-3½
Length over tube sheets, ft. and in.	21-0
Net gas area through tubes and flues, sq. ft.	10.6
Fuel	Soft-coal
Grate area, sq. ft.	100
Heating surfaces, sq. ft.:	
Firebox and combustion chamber	396
Arch tubes and Thermic Syphons	129
Firebox, total	525
Tubes and flues	5,013
Evaporative, total	5,538
Superheating (Type E)	2,342
Combined evap. and superheat	7,880
Tender:	
Style or type	Rectangular
Water capacity, U. S. gal.	22,000
Fuel capacity, tons	25
Trucks	6-wheel
Journals, diameter and length, in.	7 × 14
General Data, estimated:	
Rated tractive force, main engine, lb.	66,960
Rated tractive force, booster	14,075
Total rated tractive force, lb.	81,035
Speed at 1,000 ft. per min. piston speed, m.p.h.	42.85
Piston speed at 10 m.p.h. ft. per min.	238
R.p.m. at 10 m.p.h.	46.7
Boiler evap. (with heater) (Cook) lb. per hr.	79,640
Equiv. evap. per sq. ft. evap. h.s. per hr.	14.38
Weight proportions:	
Weight on drivers ÷ weight engine, per cent	57.2
Weight on drivers ÷ tractive force	4.08
Weight of engine ÷ evaporation	5.99
Weight of engine ÷ comb. heat. surface	60.53
Boiler proportions:	
Firebox h.s. per cent comb. h.s.	6.7
Tube-flue h.s. per cent comb. h.s.	63.6
Superheat. surface per cent comb. h.s.	29.7
Firebox h.s. ÷ grate area	5.25
Tube-flue h.s. ÷ grate area	50.13
Superheat. surface ÷ grate area	23.42
Comb. h.s. ÷ grate area	78.80
Gas area, tubes and flues ÷ grate area	0.11
Evaporation ÷ grate area	796.4
Tractive force ÷ grate area	669.6
Tractive force ÷ evaporation	0.84
Tractive force ÷ comb. h.s.	8.50
Tractive force × dia. drivers ÷ comb. h.s.	6.12



Elevation and cross-sections of the Chesapeake & Ohio 4-8-4 type passenger locomotives

three courses of nickel steel. The first is 91 11/16 in. in outside diameter and 27/32 in. thick; the second, which is tapered, is 29/32 in. thick, and the third, which extends to the throat, is 100 in. in outside diameter and 15/16 in. thick. The firebox, which has a combustion chamber 54 in. long, contains two Thermic Syphons which are supplemented by two arch tubes for the support of the Security brick arch. The crown sheet has a slope of 8¼ in. and a space of 29½ in. is provided between the crown sheet and the roof sheet. There are 65 2¼-in. tubes and 220 3½-in. flues, the length over tube sheets being 21 ft. The dome, with an opening 32 in. in diameter and a height of only 9 in., is located on the first shell course, 6 ft. ⅞ in. back of the tube sheet. The total length of the boiler, including the smokebox which is 121 in. long, is 49 ft. 5¼ in.

The grate has an area of 100 sq. ft. and a slope from back to front of 20 in. The grates are of the Firebar type and the coal is fed by a Standard Type MB stoker.

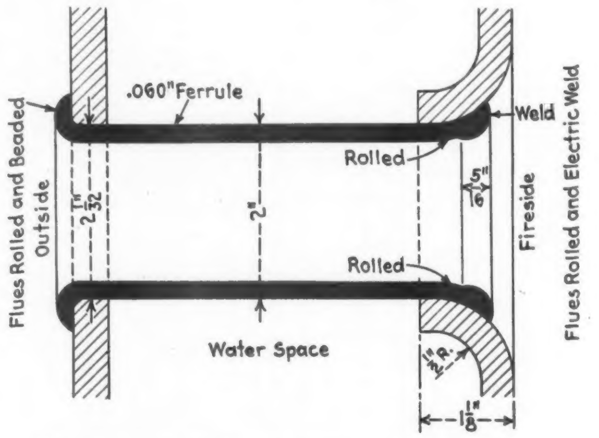
Special Equipment Applied on C. & O. 4-8-4 Type Locomotives

Builder	Lima Locomotive Works, Inc.
Road Numbers	600-604
Boiler:	
Boiler, steel, nickel	Lukens Steel Co.
Firebox steel, firebox, crown and side	Otis Steel Co.
Staybolts, flexible (Welded)	Flannery Bolt Co.
Thermic Syphons	Locomotive Firebox Co.
Brick arch (Security)	American Arch Co.
Superheater (type E)	Superheater Co.
Throttle valve, multiple	American Throttle Co.
Feedwater heater (type 5S)	Worthington Pump & Machy. Corp.
Injector, live steam	Nathan Mfg. Co.
Grates (Firebar)	Waugh Equipment Co.
Stoker (type MB)	Standard Stoker Co.
Firedoor (Butterfly 8A)	Franklin Ry. Supply Co.
Blowoff cocks, 2 in.	Wilson Engineering Corp.
Plugs, arch tube	Huron Manufacturing Co.
Plugs, throat sheet, syphon	Housley Flue Connection Corp.
Plugs, washout	Huron Manufacturing Co.
Steampipe casing (Flextite)	American Locomotive Co.
Hinges, smokebox	Okadee Co.
Lagging (85 per cent magnesia)	Johns-Manville Sales Corp.
Cab Fittings and Boiler Mountings:	
Safety valves	Consolidated Ashcroft Hancock Co.
Water column	Nathan Mfg. Co.
Whistle	Nathan Mfg. Co.
Bell ringer (improved Golmar)	Viloco Ry. Equipment Co.
Sanders	Viloco Ry. Equipment Co.
Reducing valve, steam heat	Gold Car Heating Co.
Headlight generator	Pyle National Co.
Headlight case	Pyle National Co.
Windows, storm	Prime Mfg. Co.
Cylinders and Driving Gear:	
Cylinders, steel	Ohio Steel Foundry Co.
Packing, piston rod and valve stem	Garlock Packing Co.
Cylinder cocks	Okadee Co.
Reverse gear (type E)	American Locomotive Co.
Tandem main rods	Lima Locomotive Works
Booster, trailing truck (type C2)	Franklin Ry. Supply Co.
Frames and Running Gear:	
Frames, cast steel	Ohio Steel Foundry Co.
Pilot, cast steel, drop coupler	General Steel Castings Co.
Lateral cushioning device, front wheels	American Locomotive Co.
Driving wheel centers, cast steel	Ohio Steel Foundry Co.
Truck, engine	General Steel Castings Co.
Truck, trailing (Delta 4-wheel)	General Steel Castings Co.
Wheels, engine truck, rolled steel	Carnegie-Illinois Steel Corp.
Wheels, trailer, front, rolled steel	Carnegie-Illinois Steel Corp.
Wheels, trailer, rear, centers	Ohio Steel Foundry Co.
Springs	Pittsburgh Spring & Steel Co.
Lubrication:	
Lubricators, mechanical (32B) (3)	Detroit Lubricator Co.
Lubricators, mechanical (24 pint, 16 feed) (2)	Nathan Mfg. Co.
Lubricators, hydrostatic, (3 pint, 3 feed)	Nathan Mfg. Co.
Brakes:	
Air brake (6ET)	New York Air Brake Co.
Air compressors (2-8½ in. C.C.)	New York Air Brake Co.
Driver brakes (WN 4)	American Brake Co.
Tender truck (Simplex)	American Steel Foundries
Brake shoes	American Brake Shoe & Fdry. Co.
Train control	Union Switch & Signal Co.
Couplers and Draft Gear:	
Coupler, engine (drop type)	National Malleable & Steel Cast. Co.
Coupler, tender (type E)	Buckeye Steel Castings Co.
Coupler yoke, tender	Buckeye Steel Castings Co.
Draft gear, tender	Cardwell Westinghouse Co.
Tender:	
Frame, water bottom	General Steel Castings Co.
Drawbar (Unit Safety)	Franklin Ry. Supply Co.
Buffer, radial (A1)	Franklin Ry. Supply Co.
Flexible connections	Barco Mfg. Co.
Tank valves	William Powell Co.
Trucks, six-wheel	Buckeye Steel Castings Co.
Wheels (Davis multiple-wear)	American Steel Foundries
Journal boxes	Buckeye Steel Castings Co.
Journal box lids	Buckeye Steel Castings Co.

Six combustion tubes are provided, three on each side.

The boiler is fitted with the Elesco Type E superheater, with the American multiple throttle and a Worthington type 5-S feedwater heater of 9,000 gal. capacity. The drypipe is of 10½ in. inside diameter. Superheated steam is used for the blower. All other auxiliaries are operated by saturated steam taken from a cast steel cab turret. The safety valves are mounted on a cast-steel turret attached to the roof sheet.

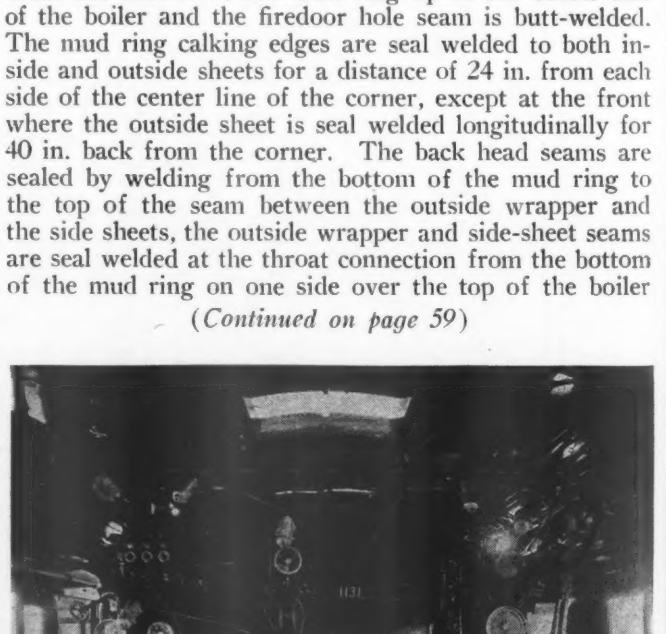
Welding has been employed at many points in the construction of the boiler. In the firebox the crown



Detail construction of the combustion tubes

sheet is butt-welded to the side sheets, the bottom sheet of the combustion chamber is butt-welded to the crown sheet, the Thermic Syphons are welded to the crown and throat sheets, the inside throat sheet is butt-welded all around, the firedoor sheet seams are butt-welded from the bottom of the mud ring up to the center line of the boiler and the firedoor hole seam is butt-welded. The mud ring calking edges are seal welded to both inside and outside sheets for a distance of 24 in. from each side of the center line of the corner, except at the front where the outside sheet is seal welded longitudinally for 40 in. back from the corner. The back head seams are sealed by welding from the bottom of the mud ring to the top of the seam between the outside wrapper and the side sheets, the outside wrapper and side-sheet seams are seal welded at the throat connection from the bottom of the mud ring on one side over the top of the boiler

(*Continued on page 59*)



View in cab of back boiler head and fittings

Equipment Orders in 1935 Fewer than in 1934

Domestic orders totaled 28 steam, 7 electric and 48 internal-combustion locomotives; 18,689 freight and 63 passenger train cars; 3 motor trains and 15 motor cars or body units. Canadian orders included 27 locomotives and 2,421 freight cars

PURCHASES of motive power and rolling stock in 1935 were unusually light, in fact, in only two or three years since 1901 has the volume of business been smaller. This was true of all kinds of equipment.

Locomotive Orders

In 1935 the railroads in the United States ordered 24 steam locomotives and those in Canada 22 steam locomotives. An additional eight locomotives for industrial service and 13 for export brought the total orders for steam locomotives up to 67. All the export orders were for South America with the exception of a single locomotive for Cuba. Of the locomotives for domestic or Canadian service 17, or 37 per cent, of the total were of the 4-8-4 type. These included five for the C. & O., 10 for the Canadian National (five each for freight and passenger service) and two for the Temiskaming & Northern Ontario. The Canadian Pacific ordered five of the 4-4-4 type for high-speed passenger service with light-weight cars. Other orders included four of the 2-8-4 type by the D. T. & I., two of the 4-8-2 type by the B. & M., eight of the 0-6-0 type by the W. & L. E.

Table I—Orders for Locomotives of All Types Since 1918

Year	Domestic	Canadian	U. S. Export	Total
1918	2,593	209	2,086	4,888
1919	214	58	898	1,170
1920	1,998	189	718	2,905
1921	239	35	546	820
1922	2,600	68	131	2,799
1923	1,944	82	116	2,142
1924	1,413	71	142	1,626
1925	1,055	10	209	1,274
1926	1,301	61	180	1,542
1927	734	58	54	846
1928	603	98	27	728
1929	1,212	77	106	1,395
1930	440	95	20	555
1931	176	2	28	206
1932	12	1 (Export)	1	14
1933	42	...	7	49
1934	182	...	17	199
1935	83	27	15	125

and two of the 2-6-6-4 type by the N. & W., the latter two orders being for construction at company shops. The B. & O. and the C. B. & Q. are each building one locomotive of the 4-6-4 type.

The 4-8-4 type again leads the steam-locomotive field. This type has fully demonstrated its ability to meet the exacting requirements for handling either heavy and fast passenger trains or heavy freight trains at the high speeds now found advisable. Probably the most notable design of the year was that of the C. & O. 4-8-4 type locomotives built for heavy passenger service on grades up to 1.5 per cent. These locomotives have unusually ample boilers and are expected to develop over 5,000 cylinder horsepower. For heavy power the N. & W. articulated locomotives are of interest. Their rated tractive force will be 104,500 lb. The tendency toward increased running speeds during 1934 has been still more noticeable in 1935. The success of the Hiawatha locomotives on the C. M. St. P. & P. has helped to focus attention on streamlining which is being experimented with in all parts of the world. Furthermore, recent steam locomotive performance has demonstrated the ability of this type of motive power to meet all service demands now visualized.

Only seven electric locomotives were ordered. Of these, only one was for railroad service—the Norfolk & Western. Since the developments on the Pennsylvania in 1934 new activity in this field has been dormant.

Orders for internal combustion locomotives in 1935 totaled 48 for service in the United States. Of these, nine were for railroad service and 39 for industrial service. With the exception of the Belt Ry. of Chicago no railroad ordered more than one locomotive. There was one 1,000-hp. Diesel-electric locomotive for the F. W. & D. C., one of 900 hp. for the P. B. & N. E., two of 600 hp. for the Belt Ry. of Chicago, and one each of 600 hp. for the A. T. & S. F., C. & I. W., and P. & P. U. Most of the locomotives ordered for industrial service were of relatively small size, only one was of 600 hp. capacity. In addition to those for domestic service, two small locomotives were ordered for export and one locomotive of 600 hp. was ordered by the Canadian Pacific.

Table II—Types and Number of Steam Locomotives Ordered in 1935

Type	Railroad U. S. and Canada	Industrial service	Export	Total
0-4-0	..	1	..	1
0-6-0	8	3	..	11
0-8-0	1	..	..	1
2-8-0	..	1	2	3
2-8-2	5	1	1	7
2-8-4	4	..	..	4
2-6-6-2	..	..	1	1
2-6-6-4	2	..	..	2
4-4-4	5	..	..	5
4-6-4	2	..	..	2
4-8-0	..	..	5	5
4-8-2	2	..	..	2
4-8-4	17	..	..	17
4-10-2	..	..	4	4
Geared	..	2	..	2
Total	46	8	13	67

The year 1935 marked the entrance of the Diesel-electric locomotive into main line passenger service. The A. T. & S. F. 3,600-hp., double-unit and the B. & O. 1,800-hp. single-unit Diesel-electric locomotives were placed in service. Another 3,600-hp. double-unit, owned by the builder, has been on trial service on several railroads. A description of the Santa Fe loco-

motive was given in the December, 1935, issue of the *Railway Mechanical Engineer.*

Freight Car Orders

Referring to Table III it will be noted that the orders for freight cars in 1935 included 18,699 for the United States, 2,421 for Canada and 110 for export. In only three years since 1901—1931, 1932 and 1933—has the total been so small. Information as to the types of cars ordered will be found in Table IV. This table shows also the distribution as between railroads and private car lines. Excluding export orders, 10,020 or 47 per cent were of the box or automobile type; 6,144 or 29 per cent of the hopper type; 3,175 or 15 per cent of the gondola type and 1,205 or 5.7 per cent of the refrigerator type. Of the refrigerator cars credited to railroads all were for Canadian roads. Of the cars ordered in the United States 11,138 were placed with outside builders and 7,561 with railroad shops.

Table III—Orders for Freight Cars Since 1918

Year	Domestic	Canadian	Export	Total
1918	114,113	9,657	53,547	177,317
1919	22,062	3,837	3,994	29,893
1920	84,207	12,406	9,056	105,669
1921	23,346	30	4,982	28,358
1922	180,154	746	1,072	181,972
1923	94,471	8,685	396	103,552
1924	143,728	1,867	4,017	149,612
1925	92,816	642	2,138	95,596
1926	67,029	1,495	1,971	70,495
1927	72,006	2,133	646	74,785
1928	51,200	8,901	2,530	62,631
1929	111,218	9,899	3,023	124,140
1930	46,360	1,936	1,200	49,496
1931	10,880	3,807	151	14,838
1932	1,968	501	77	2,546
1933	1,685	75	132	1,892
1934	24,611	12	1,323	25,946
1935	18,699	2,421	110	21,230

The largest number of freight cars ordered by any railroad in 1935 was 10,100 for the Pennsylvania. Other orders included 5,230 for the C. & O., 505 for the C. B. & Q., 500 for the C. N. O. & T. P., 500 for the Norfolk Southern, 500 for the Northern Refrigerator Line, Inc., and 485 for the N. & W. The Canadian National ordered 1,180 cars and the Canadian Pacific 1,120 cars. These Canadian orders were made possible by government loans, for which reason the Canadian orders were much larger than for several years. In placing orders for box cars there appears to be a marked tendency to follow the A. A. R. standard design. As regards the design of refrigerator cars it may not be out of place to call attention to the fact that the A. A. R. Committee on Car Design are working on a standard design and have reported progress. In methods of construction there appears to be an increased use of the welding process.

Table IV—Class and Number of Freight Cars Ordered in 1935

Class	United States and Canada Railroads	Private	Total	Export
F—Flat	75	..	75	..
G—Gondola	3,170	5	3,175	..
H—Hopper	6,140	4	6,144	30
HR—Covered Hopper	30	12	42	..
R—Refrigerator	600	605	1,205	..
T—Tank	..	269	269	2
X—Box	8,920	..	8,920	75
XA—Auto. Box	1,100	..	1,100	..
S—Stock	50	..	50	..
N—Caboose	27	..	27	..
Not classified	83	30	113	..
Total	20,195	925	21,120	110

An indication of the trend of current thought is shown in the construction of a few box and hopper cars in which special steels were employed in order to reduce the tare weight and thereby increase the ratio of revenue load to total gross weight. At the same time an increased life due to decreased corrosion is anticipated. The exact economic evaluation of the reduction in weight and the decrease in corrosion can, of course, be determined accurately only by extended service. The actual construction of such cars is, however, significant.

Passenger Equipment Orders

Orders for passenger train cars in 1935 amounted to the insignificant total of 79. The largest order was one for 55 milk cars placed by the Erie. Other orders included eight coaches, four baggage and buffet, and four mail and express cars for the Canadian Pacific, two D. & R. G. W. air-conditioned diner-observation cars to be built at the railroad's shops and two light-weight coaches for the A. T. & S. F.—one of stainless steel and one of Cor-Ten steel. These light-weight cars are to be used interchangeably with regular passenger-train equipment and are significant in indicating what the trend of future designs may be.

Table V—Orders for Passenger Train Cars Since 1918

Year	Domestic	Canadian	Export	Total
1918	9	22	26	57
1919	292	347	143	782
1920	1,781	275	38	2,094
1921	246	91	155	492
1922	2,382	87	19	2,488
1923	2,214	263	6	2,483
1924	2,554	100	25	2,679
1925	2,191	50	76	2,317
1926	1,868	236	58	2,162
1927	1,612	143	48	1,803
1928	1,930	334	29	2,293
1929	2,303	122	33	2,458
1930	667	203	15	885
1931	11	11	21	43
1932	39	..	..	39
1933	6	..	..	6
1934	388	..	15	403
1935	63	16	..	79

In the field of motor-driven equipment the C. B. & Q. ordered one completely articulated train of four body units, driven by a 660-hp. Diesel-electric power plant, while the Union Pacific ordered two complete trains. The first units in these two trains will be two power cars with a total of 2,400 hp. in Diesel-electric plants, while the train proper will consist of 10 cars, partially articulated. A brief description of these trains, which will be operated between Chicago and Denver, was given in the January issue of the *Railway Mechanical Engineer*. In addition, orders were given for six additional cars for existing motor trains—one of two articulated body units and the others single units. Nine single-unit rail motor cars were also ordered. Two of these—Seaboard Air Line—had 600-hp. Diesel-electric power plants while gasoline engines were specified for the others. Included among the single-unit cars were three light rail-buses for the Seaboard Air Line and two for the Norfolk Southern. The only export order was one for four small gasoline rail-motor cars to be shipped to Colombia.

As will be noted from the list given, the rail-motor equipment ordered in 1935 covered a wide range—all the way from the single-unit rail-buses weighing 42,000 lb. and having a 180-hp. engine with no provision for hauling a trailer which were ordered by the Norfolk Southern to the 11-car trains with 2,400-hp. locomotives ordered by the Union Pacific.

Equipment Condition

The lessened demands for motive power and rolling stock during the past few years due to a greatly reduced

volume of traffic have permitted the railroads to withdraw much of their older, lighter or poorer equipment from service and to handle such traffic as was available with their newer and better equipment. As a consequence operating results both as to speeds and fuel consumption have been highly creditable. However, the best of the equipment which was purchased less than 10 years ago is now in a condition where heavy expenditures for its maintenance must soon be made. Furthermore, it is quite generally recognized that a considerable portion of the locomotive and car inventories that have been withdrawn from active service can never again be reconditioned to be operated economically. Realizing this, a number of roads have set up definite retirement programs. The number of units of all types of locomotives and cars is steadily declining. During the past six years the decline has averaged annually 1,877 locomotives, 1,749 passenger train cars and 83,310 railroad-owned freight cars. On Class I railroads since 1929 the total number of locomotives has shown a decline of 19.4 per cent and the aggregate tractive capacity 13 per cent. While the number of unserviceable locomotives has been increasing it is feared that many of the locomotives reported as "stored serviceable" will, on account of type, size or design, be of but little practical value when a real demand for power arises. These is no disguising the fact that railroad motive power and rolling stock is getting to be not only old but some of it also too antiquated ever again to render satisfactory service. Heavy expenditures will have to be made not only for rehabilitation of such present equipment as can be economically repaired and returned to service but also for the purchase of new and modern equipment to meet the demands for higher speeds and better service which are now expected by the general public.

Annual Report of the Bureau of Locomotive Inspection

Twenty-fourth annual report again shows an increase in accidents and number of locomotives found defective

THE twenty-fourth annual report of A. G. Pack, chief inspector, Bureau of Locomotive Inspection, to the Interstate Commerce Commission shows that the record of improvement in the condition of steam locomotives and the death and accidents resulting therefrom which began in 1923 was continued steadily until 1932. Since that time there has been a steadily increasing number of accidents and each year more locomotives have been found to be defective.

The total number of steam locomotives inspected by the Bureau during the past fiscal year was 94,151, of which 11,071 or 12 per cent, were defective. This compared with 10,713 defective locomotives in the year ended June 30, 1934, 8,338 in 1933, and 7,724 in 1932. The number of locomotives ordered out of service increased to 921 against a low of 527 in 1932, while the total number of defects found was 44,491 against 27,832 in 1932, 32,733 in 1933, and 43,271 in 1934. The number of accidents due to defective locomotives showed an increase, while the number of persons killed rose to 29 against only 7 the year before.

Driving-wheel tire broken as a result of building up the flange by fusion welding

During the year 12 per cent of the steam locomotives inspected were found with defects or errors in inspection that should have been corrected before the locomotives were put into use as compared with only 8 per cent in the year ended June 30, 1932. There was an increase of 22 per cent in the number of locomotives ordered withheld from service because of defects that rendered them immediately unsafe as compared with the previous year, and an increase of 2.8 per cent in the total number of defects found. A comparison of the number of defects found over a six-year period is shown in one of the tables, from which it will be noted that the increase in

Condition of Locomotives, Found by Inspection, in Relation to Accidents and Casualties

Fiscal year ended June 30	Per cent of locomotives inspected found defective	Number of locomotives ordered out of service	Number of accidents	Number of persons killed	Number of persons injured
1925	46	3,637	690	20	764
1926	40	3,281	574	22	660
1927	34	2,539	488	28	517
1928	24	1,725	419	30	463
1929	21	1,490	356	19	390
1930	16	1,200	295	13	320
1931	10	688	230	16	269
1932	8	527	145	9	156
1933	10	544	157	8	256
1934	12	754	192	7	223
1935	12	921	201	29	267

the number of defects is represented largely by items that require heavy repairs to restore the deferred maintenance.

Boiler Explosions or Crown-Sheet Failures

Boiler explosions or crown-sheet failures continue to be the most prolific source of fatal accidents. There was an increase of four accidents, an increase of 17 in the number of persons killed, and of 39 in the number injured from this cause, as compared with the previous year. Compared with the fiscal year ended June 30, 1912—the first year the Boiler Inspection Act was operative—there has been, however, a marked improvement in conditions.

Extension of Time for Removal of Flues

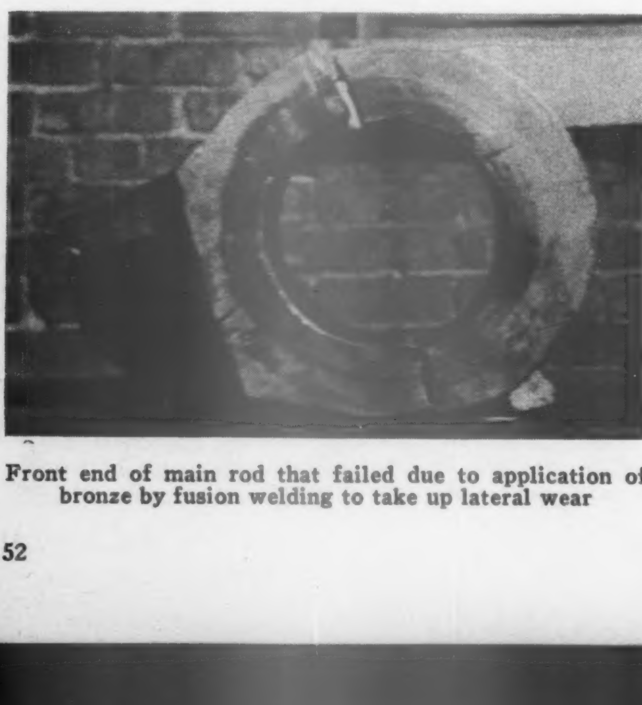
A total of 1,401 applications were filed for extensions of time for removal of flues, as provided in Rule 10. Investigations disclosed that in 84 of these cases the condition of the locomotive was such that an extension could not be granted. One hundred twenty-nine were in such condition that full extensions requested could not be authorized, but extensions for shorter periods were allowed. Extensions were granted in 141 cases after defects disclosed by investigations were repaired. Twenty applications were canceled for various reasons. Applications totaling 1,027 were granted for the full period requested.

Other Types of Locomotives

Inspection made of locomotives other than steam showed the same trend of increasing defects and a greater number of accidents. Compared with the previous year the number of locomotives found defective increased from 69 to 146, and the number of defects from 158 to 447. There were eight persons injured due to defects against only one in 1934. No deaths due to defective equipment have occurred in the past four years.

Specification Cards and Reports

Under Rule 54 for Inspection and Testing of Steam Locomotives 209 specification cards and 3,185 alteration reports were filed, checked and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found. Under Rules 328 and 329 for Inspection and Testing of Locomotives Other than Steam 308 specifications and 29 alteration reports were filed for locomotive units and 92 specifications and 62 alteration reports for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found. No formal appeal by any carrier was taken from the decisions of any inspector during the year.



Front end of main rod that failed due to application of bronze by fusion welding to take up lateral wear

Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing or in violation of rules	Year ended June 30— 1935	1934	1933	1932	1931	1930
1. Air compressors	733	660	474	417	481	873
2. Arch tubes	74	127	51	54	60	87
3. Ash pans & mechanism	94	87	40	69	81	76
4. Axles	10	6	21	13	10	12
5. Blow-off cocks	283	289	210	144	191	325
6. Boiler checks	413	407	293	214	263	521
7. Boiler shell	395	372	296	220	430	579
8. Brake equipment	2,449	2,326	1,696	1,645	1,923	2,706
9. Cabs, cab windows and curtains	1,273	1,342	1,183	851	1,484	3,066
10. Cab aprons and decks	368	343	309	262	415	710
11. Cab cards	142	129	121	162	211	226
12. Coupling and uncoupling devices	73	54	67	85	98	122
13. Crossheads, guides, pistons, and piston rods	1,086	1,100	773	763	856	1,421
14. Crown bolts	75	77	67	50	96	95
15. Cylinders, saddles, and steam chests	1,547	1,491	1,084	841	1,265	2,311
16. Cylinder cocks and rigging	627	654	374	376	411	848
17. Domes and dome caps	94	105	76	45	83	154
18. Draft gear	423	401	318	325	568	950
19. Draw gear	414	480	357	371	640	1,003
20. Driving boxes, shoes, wedges, pedestals, and braces	1,573	1,472	1,080	821	925	1,359
21. Firebox sheets	343	356	246	235	341	471
22. Flues	173	203	150	120	187	254
23. Frames, tailpieces, and braces, locomotive	1,006	951	669	611	740	1,271
24. Frames, tender	124	128	80	86	105	177
25. Gages and gage fittings, air	275	212	145	156	192	290
26. Gages and gage fittings, steam	320	289	258	214	324	553
27. Gage cocks	480	384	388	330	415	783
28. Grate shakers and fire doors	394	404	245	288	410	767
29. Handholds	464	377	363	382	562	865
30. Injectors, inoperative	39	33	20	31	55	103
31. Injectors and connections	2,035	1,909	1,357	1,168	1,815	3,275
32. Inspections and tests not made as required	8,344	8,173	6,358	3,801	4,862	7,456
33. Lateral motion	389	351	269	237	289	372
34. Lights, cab and classification	81	79	76	55	77	119
35. Lights, headlights	257	218	169	119	180	373
36. Lubricators and shields	191	215	157	119	176	312
37. Mud rings	241	247	232	166	318	445
38. Packing nuts	527	491	419	402	523	828
39. Packing, piston rod and valve stem	906	833	592	444	706	1,429
40. Pilot and pilot beams	152	174	123	145	160	272
41. Plugs and studs	167	242	151	176	182	348
42. Reversing gear	414	390	254	202	299	579
43. Rods, main and side, crank pins, and collars	1,826	1,670	1,327	1,256	1,520	2,488
44. Safety valves	100	103	53	63	61	116
45. Sanders	779	697	376	289	314	804
46. Springs and spring rigging	2,765	2,854	2,122	1,851	2,161	3,311
47. Squirt hose	113	107	93	96	184	313
48. Stay bolts	140	285	219	181	293	395
49. Stay bolts, broken	512	455	368	552	938	1,098
50. Steam pipes	463	489	338	285	512	730
51. Steam valves	212	267	193	143	226	399
52. Steps	640	567	498	622	676	1,021
53. Tanks and tank valves	913	862	600	587	732	1,426
54. Telltale holes	102	93	90	108	151	183
55. Throttles and throttle rigging	733	639	448	434	574	1,175
56. Trucks, engine and trailing	811	898	664	648	714	1.141
57. Trucks, tender	1,120	918	747	766	1,059	1,531
58. Valve motion	799	784	640	520	497	827
59. Washout plugs	679	776	623	599	815	1,283
60. Train-control equipment	4	8	4	13	9	48
61. Water glasses, fittings and shields	951	907	716	676	955	1.501
62. Wheels	697	734	580	603	750	1,025
63. Miscellaneous — signal appliances, badge plates, brakes (hand)	563	572	423	325	418	691
Total number of defects	44,491	43,271	32,733	27,832	36.968	60.292
Locomotives reported	51,283	54,283	56,971	59,110	60,841	61.947
Locomotives inspected	94,151	89.716	87,658	96,924	101,224	100.794
Locomotives defective	11,071	10,713	8,388	7,724	10,277	16,300
Percentage of inspected found defective	12	12	10	8	10	16
Locomotives ordered out of service	921	754	544	527	688	1,200

Turbine Locomotive Built by London, Midland & Scottish

Non-condensing turbine locomotive differs in the fewest particulars from other 4-6-2 standard type locomotives

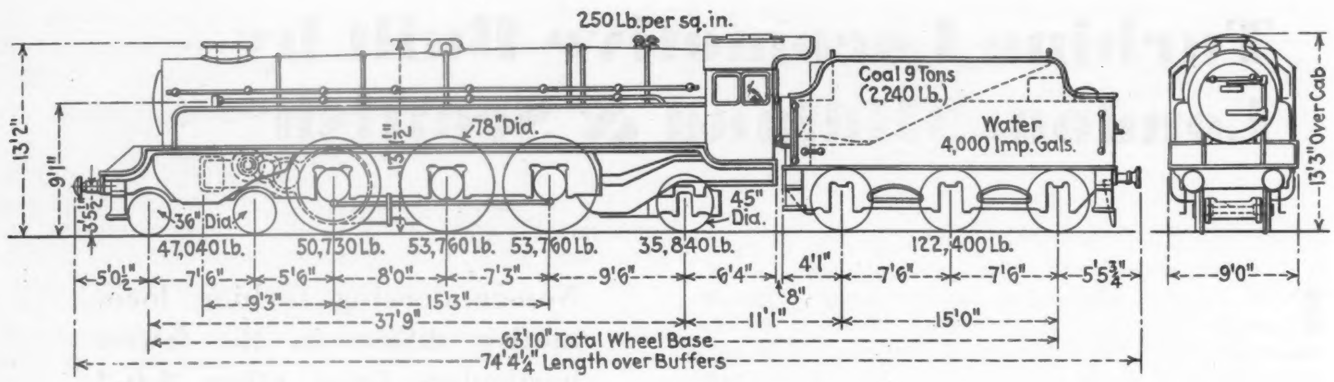
THE London, Midland & Scottish Railway has recently completed at its Crewe Works a turbine locomotive, No. 6202, built for test purposes. This locomotive, which is of the Pacific type, is fitted with a non-condensing turbine of the Ljungstrom-Lysholm type, the turbine and the reduction gearing being designed and supplied by the Metropolitan Vickers Electrical Company, Ltd. In reality two turbines are employed, an ahead turbine located on the left-hand side in the place usually occupied by the reciprocating-engine cylinder and steam chest and a reverse turbine located on the right-hand side. The ahead turbine has six nozzles, two Curtis stages and several expansion stages. It is permanently connected to the triple-reduction gear located between the frames underneath the smokebox. The reduction gear is coupled to the leading pair of driving wheels by means of a quill drive of a general design similar to that used on some electric locomotives. This turbine develops over 2,000 hp. at full admission. The reverse turbine, which is smaller, has three nozzles and two Curtis stages. When the locomotive is running ahead the reverse turbine is disconnected.

Similar Conventional Locomotives

Until recently the L.M.S. has employed 4-6-0 type locomotives in handling its heavy passenger traffic. In 1933, however, a design was worked out for a 4-6-2 type locomotive and two engines—Princess Royal, No. 6200, and Princess Rose, No. 6201, were built and placed in service. These locomotives had four single-expansion cylinders, 16¼ in. by 28 in., 78-in. drivers, 250 lb. boiler pressure, 40,300 lb. rated tractive force, and weighed 234,000 lb. in working order, exclusive of tender. The boilers had 2,713 sq. ft. evaporative heating surface, of which 190 sq. ft. was in the firebox and 2,523 sq. ft. in the tubes and flues. To this should be added 370 sq. ft., in the 16 superheater elements. These locomotives were designed to handle trains weighing from 500 to 560 tons (2,000 lb.) between London and Glasgow and permit a reduction in the running time of trains already noted for their high speeds.

These locomotives have submitted to many tests. As an example of their performance a test run made on June 27, 1935, may be cited. The train hauled, consisting of 14 passenger cars and a dynamometer car, weighed 508 tons light or 532 tons including an allowance for passengers. The run from Liverpool to London (Euston), a distance of 193.7 miles, was made in 3 hr. 20 min., including two stops at Crewe and Willesden, a total of five minutes. The run of 152.7 miles from Crewe to Willesden was made in 129½ min., including a number of slow-downs. This was at an average speed of 70.7 m.p.h. and a maximum speed of 86.6 m.p.h. Following the Liverpool-London run a dynamometer car test run was made from Crewe to Glasgow and return, a total distance of 486.6 miles. The train consisted of 20 cars and weighed 516 tons, exclusive of the passengers and luggage carried. On this section of the road there are a number of long grades ranging from 1 to 1.4 per cent. The average records for the Crewe-Glasgow runs gave a coal consumption of 52.6 lb. per mile and 47.1 U. S. gallons of water per mile. The coal consump-

Left hand side of L.M.S. non-condensing turbine locomotive—Control mechanism and piping are concealed by the housing above the running board

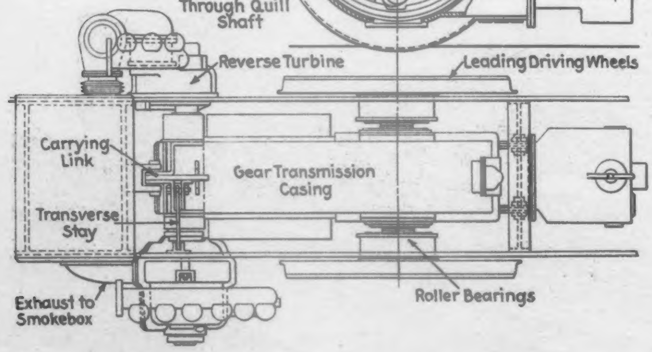


Elevation of the London, Midland & Scottish turbo-locomotive

tion per drawbar horsepower-hour was 2.88 lb. These rates are equivalent to 102 lb. of coal per 1,000 g.t.m. of train and an evaporation rate of 7.43 lb. of water per pound of coal.

Boiler Design Modified

After the highly satisfactory performance of the first two Pacific type locomotives built in 1933 orders were given for the construction of ten additional locomotives in 1935, which carry numbers 6203 to 6212, inclusive. The modifications made in the design at this time were slight, aside from certain changes in the boiler. A combustion chamber 43½ in. long was added which increased the firebox heating surface from 190 to 217 sq. ft. Instead of 170 tubes 2¼ in. in diameter and 20 ft. 9 in. long employed in the original boiler design, the number was reduced to 112 tubes, 19 ft. 3 in. long. The original boiler had, in addition, 16 flues, 5⅛ in. in diameter, while the new boilers have 32 flues of the same diameter. These changes reduced the tube and flue heating surface from 2,523 sq. ft. to 2,097 sq. ft. The superheater elements, which have an outside diameter of 1¼ in., provided 370 sq. ft. heating surface in the original design and 653 sq. ft. in the revised design. The first two boilers were designed to furnish steam at 550 deg. F. temperature, and the later boilers at 750 deg. F., the temperature of saturated steam at 250 lb. boiler pressure



General arrangement of turbines and reduction gear showing method of driving the leading axle

being 406 deg. F. From the changes described it will be noted that the volume of the firebox has been increased which should improve combustion and that the superheating capacity has been raised appreciably.

The boilers are of the Belpaire design, which is quite widely used in Great Britain, and the fireboxes are of copper. The firebox sheets are ⅝ in. thick and the back flue sheet 1 in. thick. The foundation or mud ring is level at the back and then slopes downward at the front. On the inside the firebox is 91¾ in. long, being 66¼ in. wide at the back and increasing to a width of 76⅝ in. at the front. The grate area provided is 45 sq. ft.

The distance from the bottom of the mud ring to the center line of the boiler is 82¾ in. at the front and 15 in. from center line to the crown sheet. At the back end the distance from the bottom of the mud ring to the center line is 74⅞ in. and from the center line to the crown sheet the distance is 11⅞ in.

The barrel and firebox wrapper sheets are of 2 per cent nickel steel. Welding, in addition to riveting, is employed on the seams of the wrapper sheet and along the longitudinal barrel seams for a distance of 12 in. from each end. Circumferencial barrel seams are welded at the bottom for a distance of 2 ft. on each side of the center line. Welding is also used around the corners of the mud ring and at several other points. Monel metal stays, ⅞ in. in diameter, 11 threads, are employed on the two outer side rows and on the top six rows and also in the curved portion of the throat. On the back head the top three rows are of copper, ⅞ in. diameter, 11 threads, and the balance are of mild steel, ⅝ in. diameter, 11 threads.

The boiler is fed by means of an exhaust-steam injector located on the fireman's side. This injector uses exhaust steam from the ahead turbine and discharges through a feedwater heater also supplied with exhaust steam from the ahead turbine. A live steam injector is provided on the other side of the locomotive.

The height of the stack above the top of the rail is only 13 ft. 3 in. and the width of the engine overall is 9 ft. The space permitted over the crown sheet is 2 ft. No steam dome is provided. The steam pipe is of the collector and dryer type, with inlet at the highest point above the back tube sheet. The throttle is incorporated in the superheater header.

The boiler used on the turbine locomotive, No. 6202, is the same as the later design employed on the ten conventional locomotives built in 1935. In running gear and in all other details possible the turbine locomotive is the same as on the others of the group so that comparative values may be obtained in service. The leading

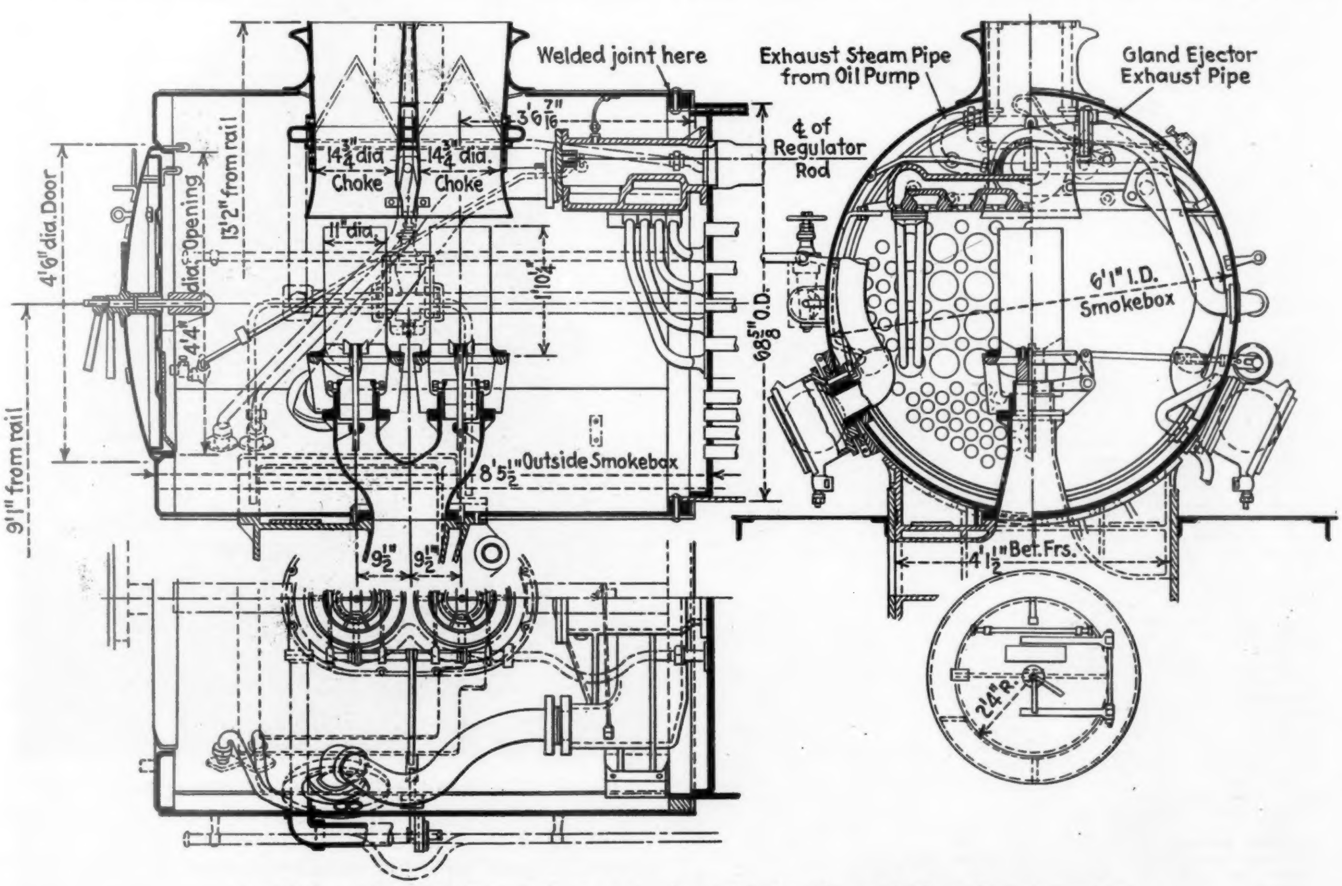
dimensions, weights and proportions of both types of locomotives are given in an accompanying table.

Turbines and Reduction Gear

The turbines are bolted to the outside of the plate frames at the front end, the ahead turbine on the left-hand side and the back-up turbine on the right-hand side. The turbine spindles are at right angles to the track or parallel to the locomotive driving axles. The ahead turbine is flexibly coupled to the high-speed pinion of the triple-reduction gear. The gear mechanism, which is of the double-helical type and enclosed in a fabricated gear case, is suspended from three supports on the engine frame, one at the front end and two at the rear. Provision is made in the first and second pinions for slight flexibility in order to equalize the pressure along the gear teeth.

In order to care for the vertical movements of the driving axle relative to the frame, the final drive from the low-speed gear to the leading driving axle is made highly flexible. Referring to one of the drawings, it will be noted that the low-speed gear encircles the driving axle and is coupled to it by a series of floating links. The gear has two opposite internal lugs to which links are attached. The free ends of these two links are connected to a large floating link which surrounds the axle. This floating link in turn is connected by two other links to arms which are a part of the driving axle shaft. The reverse turbine is provided with an additional single-reduction gear which is connected to the high-speed pinion of the main gear previously described by a mechanical clutch operated from the locomotive cab.

Steam from the superheater header, after passing through the main throttle valve, which is always kept open while the locomotive is in operation, is led to steam chests on the right- and left-hand sides in a manner similar to ordinary practice. Its passage from the steam chests to the various turbine nozzles is controlled by regulating valves operated from the control box on the left-hand side of the cab immediately in front of the engineman. The control mechanism itself is quite simple. There is a small horizontal panel with six numbered steps for operating the admission valves to the nozzles of the ahead turbine and three for the reverse turbine. There is also a clutch lever for connecting the reverse turbine, this being so interlocked that it cannot be moved except when the locomotive is standing still. To reverse, steam is first shut off and the engine brought to a stop by the brake. After this has been done the reverse turbine may be connected by means of a steam-operated clutch and steam then admitted to this turbine. When the locomotive is backing up, the ahead turbine revolves backwards. Both turbines exhaust to the atmosphere through double variable nozzles and a twin stack. A back pressure as low as 2 lb. per sq. in. is anticipated.



Smokebox of the L.M.S. turbo-locomotive with double, variable exhaust nozzle

All bearings on the turbines and the reduction gear, as well as the gear teeth, are mechanically lubricated, the oil being pumped from a well in the bottom of the reduction gear casing by a submerged pump. This is supplemented by a secondary steam-driven pump located outside and ahead of the gearing. This pump also provides means for circulating the oil through the cooler and may be operated while the locomotive is standing. The radiator for cooling the oil is located on the front deck ahead of and beneath the smokebox and is clearly shown in the front-end view of the locomotive.

Running Gear and Tender

The running gear is of the 4-6-2 type with 78-in. rod-connected driving wheels. The weight of the locomotive is 241,900 lb., of which 158,250 lb. is on the drivers, 43,000 lb. on the front truck, and 40,650 lb. on

the trailing truck. Timken roller bearings are used on the journals of all driving axles, leading and trailing-truck axles, and also on the tender axles.

The frames are of high-tensile steel plates, 1¼ in. thick. The load on the driving wheels is carried by underhung semi-elliptic springs. Each spring is independent; no equalized spring rigging such as is universal in American practice is provided. The spring plates are of silico-manganese steel. An easy spring movement is obtained by the introduction of auxiliary dampening springs between the frame brackets and the spring hangers. These dampeners consist of alternate layers of thin steel plate and rubber.

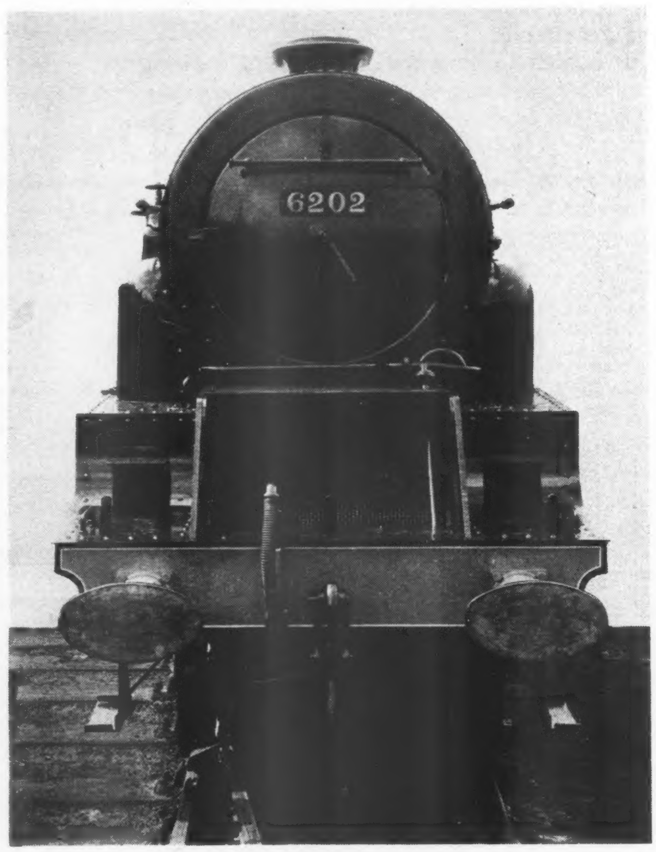
Dimensions, Weights and Proportions of L. M. S. Pacific Type Locomotives

	Four cylinder	Turbine
Railroad	L.M.S.	L.M.S.
Type	4-6-2	4-6-2
Road numbers	6203-6212	6202
Date built	1935	1935
Service	Passenger	Passenger
Height of stack	13 ft. 3 in.	13 ft. 3 in.
Width overall	9 ft. 0 in.	9 ft. 0 in.
Cylinders, diameter and stroke	4 — 16¼ in. by 28 in.	Turbine
Valve gear, type	Walschaert	......
Valves, piston type, size	8 in.	......
Maximum travel	7¼ in.	......
Weights in working order, lb.:		
Total engine	234,080	241,900
On drivers	151,200	158,250
On front truck	47,040	43,000
On trailing truck	35,840	40,650
Tender	122,400	122,400
Wheel bases:		
Driving	15 ft. 3 in.	15 ft. 3 in.
Total engine	37 ft. 9 in.	37 ft 9 in.
Total engine and tender	63 ft. 10 in.	63 ft. 10 in.
Length over buffers	74 ft. 4¼ in.	74 ft. 4¼ in.
Wheels, diameter outside tires:		
Driving	78 in.	78 in.
Front truck	36 in.	36 in.
Trailing truck	45 in.	45 in.
Boiler:		
Type	Belpaire	Belpaire
Steam pressure	250 lb.	250 lb.
Diameter, first ring, outside	68⅝ in.	68⅝ in.
Diameter at back tube sheet	75 in.	75 in.
Firebox, length	91¾ in.	91¾ in.
Firebox, width	73 in. to 66¼ in.	73 in. to 66¼ in.
Height mud ring to crown sheet, back	62⅞ in.	62⅞ in.
Height mud ring to crown sheet, front	82 in.	82 in.
Combustion chamber length	43½ in.	43½ in.
Tubes, number and diameter	170 — 2¼ in.	170 — 2¼ in.
Flues, number and diameter	16 — 5⅝ in.	16 — 5⅝ in.
Length over tube sheets	19 ft. 3 in.	19 ft. 3 in.
Grate area	45 sq. ft.	45 sq. ft.
Heating surfaces. sq. ft.:		
Firebox and comb. chamber	217	217
Tubes and flues	2,097	2,097
Total evaporative	2,314	2,314
Superheating	653	653
Comb. evaporative and superheat	2,967	2,967
Exhaust steam injector	Yes	Yes
Tender:		
Style	6-wheel	6-wheel
Water capacity	4,800 U. S. gal.	4,800 U. S. gal.
Fuel capacity (2,000 lb. tons)	10 tons	10 tons
Wheel base	15 ft. 0 in.	15 ft. 0 in.
General data estimated:		
Rated tractive force, 85 per cent	40,300	......
Cylinder horsepower (Cole)	2,375	......
Potential horsepower (Cook)	1,907	......
Speed at 1,000 ft. piston speed	49.70	......
Piston speed at 10 m.p.h.	201.2 ft.	......
Weight proportions:		
Weight on drivers ÷ total weight engine, per cent	64.6	65.4
Weight on drivers ÷ tractive force	3.75	......
Total weight engine ÷ comb. heat. surface	78.9	81.5
Boiler proportions:		
Tractive force ÷ comb. heat. surface	13.58	......
Tractive force × dia. drivers ÷ comb. heat. surface	1,059	......
Firebox heat. surface, per cent comb. heat. surface	7.3	7.3
Tube-flue heat. surface, per cent comb. heat. surface	70.7	70.7
Superheat surface, per cent comb. heat. surface	22.0	22.0
Firebox heat. surface ÷ grate area	4.82	4.82
Tube-flue heat. surface ÷ grate area	46.60	46.60
Superheat. surface ÷ grate area	14.51	14.51
Comb. heat. surface ÷ grate area	65.93	65.93
Potential horsepower ÷ grate area	42.35	42.35
Comb. heat. surface ÷ potential horsepower	1.55	1.55

The tender, which is of the six-wheel type quite generally used on British locomotives, weighs 122,400 lb. loaded and has a capacity for 4,800 U.S. gallons of water and ten tons of coal. It is fitted with a water pick-up.

Smokebox Arrangement

The smokebox on the locomotive has several unusually interesting features. The substitution of a turbine for a reciprocating steam engine necessitated a number of changes, as might be anticipated in view of the fact that the turbine exhaust is practically a steady blow and that the anticipated exhaust pressure is only two pounds. A



Front view showing oil-cooling radiator below the smokebox

double exhaust pipe and smokestack was adopted. This permitted the exhaust pipes from several of the auxiliaries to be carried up in the space between the two parts of the stack. The combination of the two stacks in a single casting has been well worked out and does not detract from the appearance of the locomotive. In order to assure the desired draft regardless of the number of nozzles opened to the turbine a variable type of exhaust nozzle is employed. As will be noted from the drawing the design used provides a central conical plug which is raised and lowered automatically as the amount of exhaust steam is increased or decreased. Straight petticoat pipes, 11 in. inside diameter, are employed. The inside diameter of the stacks at the point of choke is 14¾ in.

The operation of the turbines non-condensing has made it possible to greatly simplify the design as compared with that required for a condensing turbine locomotive. The method of controlling the turbine by several nozzles provides a wide range of flexibility and should assure a high economy.

Enginehouse Foreman Driven to Golf

Sad condition of affairs with too much leisure staring him in the face

[The recent discussion in our pages of the hardships under which many enginehouse foremen have to work has brought all sorts of comments and letters to the editor's desk. The saddest and most pathetic of all these is realistically expressed in the following communication from an enginehouse foreman, who is dismayed as he faces the problem of what to do with the leisure time that he will be compelled to utilize under changed conditions.—*Editor.*]

Three shifts for enginehouse foremen is something that should be viewed from every angle. For a starter, we "view with alarm" the paragraph on page 386 of the September, 1935, *Railway Mechanical Engineer*. Being very conservative, in the full sense of the word, we venture the opinion that the time is hardly ripe for three shifts. The thing will have to be worked out gradually, because, as we see it, the venture is fraught with perils galore.

Likely as not the enginehouse foreman going home at 3:00 p. m. under the new arrangement would be met and bitten by the family watch dog. He would no sooner get inside the door 'ere the neighborhood busybody would come visiting to inquire if the head of the house had come home sick, or just what was going on that would cause a man who had worked 12 hours a day over a period of years to "knock off" and come home in the middle of the afternoon—all of which would have to be explained more than once.

With all this newly acquired leisure "the bull of the woods" would undoubtedly be prevailed upon by his well meaning friends to take up golf. Not much of a strain is required upon the imagination to picture what a spectacle he would present in his golf togs—gaunt and stooped with knotty joints and bony legs, and one of those caps common to golfers pulled low on his brow, he ambles forth with the peculiar gait acquired by 20-odd years traveling about the circular course of a roundhouse in the necessary performance of his duties, and hereinafter referred to as "following up the work".

If he fares no better at golf than your correspondent at making hooks and slices and retrieving lost balls out in the "rough", it will bring forth a brand of language that will wither the grass in his wake.

Almost every one will agree that enginehouse foremen are not (collectively) an ungrateful lot and necessity requires that our newly made golfer make some iron shots. We vision him spitting out the turf that flew into his mouth, and you will probably hear him remark, "Thank goodness, they don't pasture cows on this grass."

Beginner's luck doesn't cut much of a figure with golfers, and our enginehouse foreman gone golfer would probably venture some opinions about the balls being out of counterbalance, thus causing those unusual curves. The clubs also will be under suspicion as to hidden defects that would cause or contribute to poor shots, and it is a dead ball that goes only 90 yards on the drive off, instead of the intended 275, etc.

About nine holes of this, with old Sol right out in front, isn't doing his neck any good, and evening will find him trying to reduce the burning on his back and soothe his aching joints as he lies back in his favorite chair with the old "hay burner" pipe and house slippered feet.

Domestic tranquility will prevail until Junior makes that great breach of etiquette, innocently inquiring, "How do you like golf, Pa?"

Go easy, boys, on this eight-hour day for the enginehouse foreman. It might get to be a national issue and get into the Supreme Court for a decision. That court might hand down a verdict, or just an opinion maybe, which when boiled down to ordinary talk would mean something about like, "It is hard to teach an old dog new tricks."

As I stated at the beginning, I'm a conservative and the best definition of a conservative that I have heard for some time was in one of the addresses at a purchasing agents' and stores meeting, wherein the speaker stated a conservative is one who is "not the last to discard the old nor the first to take up the new." With this thought in mind may I respectfully suggest that those contemplating the "New Deal" for enginehouse foremen, buy their golf togs, etc., on 30 days' trial, or 30 days "come and get 'em".

* * *

For explanation see page 88.

Fusible Drop Plugs On Southern Pacific*

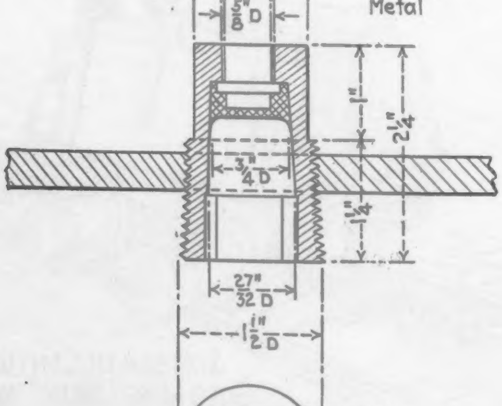
THE use of fusible plugs in the crown sheets of locomotive boilers goes back to an early date and at one time the practice was quite general. In the most common form the plug consisted of a shell with a central hole about ½ in. in diameter which was filled with a composition of lead, tin and other metals, having a low melting point. Due to changes which took place in the soft metal after long exposure to heat and due to the formation of scale on top of the plugs, they often failed to function when low water permitted the crown sheet to be subjected to a higher than normal temperature. As a consequence railroads generally lost confidence in them and but few roads continued to apply them.

Believing that the theory of the fire-actuated fusible plug was sound in principle, the Southern Pacific carried on a research to develop, if possible, a plug of satisfactory design. As a result of the investigation and experiments a design was adopted in 1915 in which the plug was provided with a central steel button ½ in. in diameter held in place by fusible metal in a hole .002 in. larger than the button.

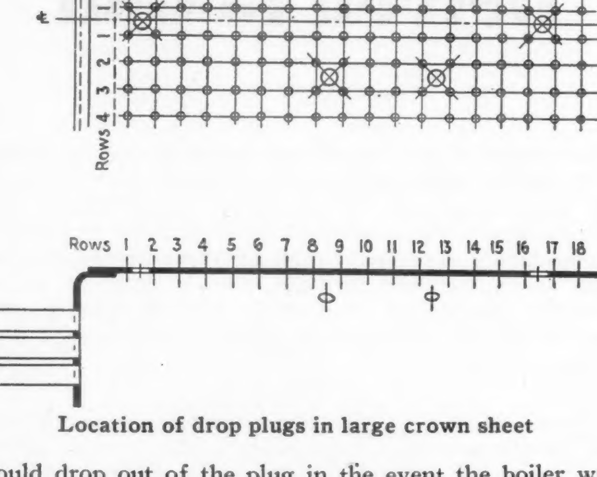
In the latter part of 1931 further improvement in the design and manufacture of this drop plug was made with a view to obtaining the objective that, when the plugs fused, the fire would be so interfered with that it would be difficult and perhaps impossible, for anyone to continue to manipulate any device that would continue the operation of the locomotive under such conditions. The drop plug thus designed and perfected is shown in one of the illustrations.

In general appearance the plug is similar to the original design, but particular attention is invited to the dimensions governing the application of the button. During the period when the new plug was being developed, the conclusion was reached that the diameter of the button should be enlarged from ½ in. to ⅝ in. This change increased the area of the opening 56 per cent. The reason for doing this was to increase the load on the button at a given boiler pressure, so that the button would drop out of the plug in the event the boiler was fired up without sufficient water over the crownsheet and full boiler pressure had not yet been reached.

* Abstracted from a special report by O. H. Kurfinke, boiler engineer, Southern Pacific, to the Master Boiler Makers' Association, at the meeting held September 18, 1935. Full report and discussion are given in the Boiler Maker and Plate Fabricator, October, 1935.



Drop plug for crown sheets of S. P. locomotives



Location of drop plugs in large crown sheet

A further advantage of the ⅝-in. diameter opening in the plug is that much more steam will be admitted to the firebox when the plugs fuse. Experience with the ⅝-in. opening has shown it to be of ample size, for in cases of low water it has been found that the sheet in the vicinity of the plug location is not discolored and bears no evidence of having become overheated.

It was also considered necessary to increase the thickness of fusible metal between the button and the plug body. The original plug had 0.001 in. thickness of fusible metal. The reason for this increase was that oxidation has a deteriorating effect on the fusible metal and the more rapidly the fusible metal is heated and cooled down the more rapid becomes the process of oxidation.

As these drop plugs fuse due to a rise in temperature through the plug body, the larger the button diameter (of course within certain limitations) the more rapidly the plug will function under the same boiler pressure. For instance, when the heat gradually increases the fusible metal will begin to soften and, when it reaches a certain degree of softness, the pressure on the button will force it out of the plug body. Where a boiler is fired up without sufficient water and pressure in the boiler is very low, the thickness of fusible metal is such that it will melt to a liquid state and, in so doing, the button will fall out at the first indication of a load upon it. As the pressure gradually increases and the plugs fuse in multiple, the hazard of accident is less likely, since the higher the pressure becomes the greater also becomes the volume of escaping steam. Within a short time the disturbance thus created will direct the attention to the fact that something is wrong.

From the foregoing one can easily visualize the effectiveness of the button-equipped drop plug compared with the solid alloy-metal fusible plug and the improvement in the design of the drop plug as compared with the original design.

Our experience satisfies us that our locomotive boilers have increased in size beyond the capacity of one or two plugs, as we have had cases where these large boilers can continue to be fired and the engine worked against the blowing of two drop plugs.

To overcome this it was necessary to equip large fireboxes with an increased number of drop plugs to obtain an effect similar to that of the sprinkler systems so successfully used in large buildings, which release a spray of water automatically in case of fire. Such an

application of drop plugs is termed a multiple application. The second illustration shows a plan view of the crownsheet of a locomotive firebox with combustion chamber having 513 sq. ft. of heating surface and a grate area of 139 sq. ft. The number of drop plugs—viz., six—is based on the application of one plug at the highest point of the crownsheet between the first and second rows of stays and one additional plug for each 400 sq. in. of gas area of the flues, so located that the main group or the majority of these plugs are in the crownsheet directly over the hottest portion of the firebox.

C. & O. 4-8-4 Locomotive

(Continued from page 48)

and down to the bottom of the mud ring on the other side, the throat seam to the third sheet course is completely seal welded, the longitudinal boiler seams are seal welded at each end for a distance of 12 in., and the outside butt-strap on the third course longitudinal seam is seal welded in the stayed zone of the combustion chamber. In addition, the combustion tubes are seal welded on the fire side, all tubes and flues are welded at the firebox end and the staybolt MK caps and UW sleeves are welded.

The cylinders are 27½ in. in diameter by 30 in. stroke. With 250 lb. boiler pressure and 72-in. drivers a rated tractive force of 66,960 lb. on an 85 per cent basis is thus provided. A Franklin type C-2 long cutoff booster with slip control and check valves is applied to the trailing truck. This adds 14,075 lb. to the tractive force, bringing the total for the main engines and the booster up to 81,035 lb. The exhaust from the booster is piped to an integral passage cast in the front side of the smoke stack.

The two cylinders, spaced on 91½-in. centers, are annealed carbon-steel castings of the half-saddle type with 14-in. piston valves having a maximum travel of 7½ in. The steam lap is 1⁹⁄₁₆ in., the exhaust clearance ³⁄₁₆ in., and the lead ¼ in. Steam and exhaust passages are direct and of large area to reduce the losses due to drop in steam pressure and back-pressure resistance. Flextite steam pipe casings are provided. The back cylinder heads are separate castings. Conventional bolting of the cylinder castings is supplemented by electric welding at the saddle splice joint and at the frame fits. The valves are operated by Walschaert gear under control of an Alco type E reverse gear. The crossheads and guides are of the multiple-bearing type.

The frames are of the bar type, each a separate annealed carbon-steel casting and joined together by the conventional type of transverse cast-steel bracing, with a cast-steel deck plate at the front and a steel cradle casting under the firebox. The pilot is of the cast-steel type and provided with a pocket into which the front coupler may be dropped when not in use.

The first, third and fourth driving axles have 11⅞-in. by 13-in. journals on the left side and 12-in. by 13-in. journals on the right side. The second, which is the main driving axle, has 12⅞-in. by 13-in. journals on the left side and 13-in. by 13-in. journals on the right side. This difference of ⅛ in. in right- and left-hand journals on the same axle is in accordance with the general practice on the C. & O. and permits of shifting crown brasses from one side to the other as wear takes place. This same practice is also applied to crank pins. All axles, crank pins and rods are open-hearth carbon steel forgings, normalized and annealed. The Alco lateral cushioning device is applied to the front driving boxes. The locomotives are fitted with tandem main rods operating on the crank pins of the second and third pairs of wheels. This design of side rods requires no knuckle pins.

All axle journals, crank pins and guides have been provided with ample bearing areas so that all bearing pressures on these locomotives and tenders are exceptionally low.

The four-wheel leading truck is of the General Steel Castings constant-resistance rocker type, with inside journal boxes. The four-wheel trailer truck is of the Delta type.

Force-feed lubricators furnish oil to the guides, the steam chests and cylinders, the engine truck boxes, the air pumps and the hot-water feedwater pump. The mechanical lubricators on three of the locomotives are the Detroit 32-B type, and on two, the Nathan 24-pint, 16-feed type. A three feed, three-pint hydrostatic lubricator is provided for the booster and the stoker engine.

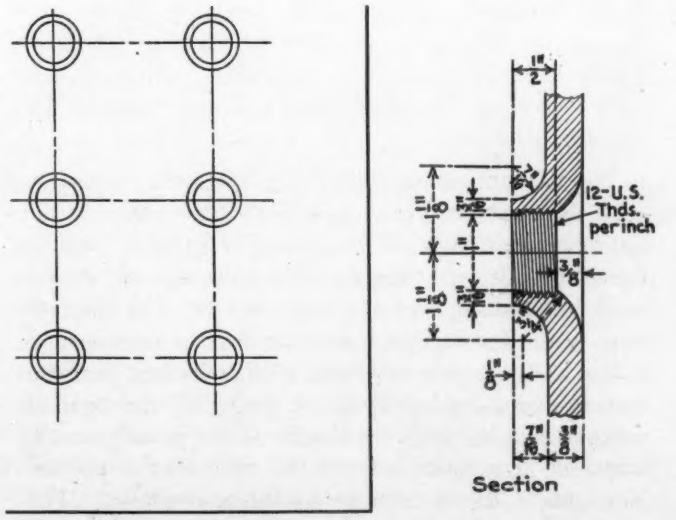
The locomotives are provided with New York No. 6-ET brake equipment, including two 8½-in. cross-compound air compressors, mounted on the front deck on brackets extending under the front end of the smokebox. They are equipped with the Union Switch & Signal Company's intermittent induction type train control.

The rectangular water bottom tender has a capacity for 25 tons of coal and 22,000 U. S. gallons of water. It is carried on two Buckeye type, six-wheel trucks and has a loaded weight of 381,700 lb. The stoker engine is housed in the left side of the tender in a compartment set in the front water leg. The Franklin Unit Safety drawbar and the type A-1 Radial Buffer are provided between the engine and tender. Simplex brakes are applied to the trucks.

Flanged Staybolt Holes on C. & O.*

THE Chesapeake & Ohio is experimenting with flanged staybolt holes for firebox sheets which it is anticipated will add flexibility and reduce the danger of cracks starting from such holes. Two locomotives have thus far been equipped. Both have completed one-half of this mileage cycle and thus far no staybolts have required repair until the engines were shopped.

* From a discussion at the September, 1935, meeting of the Master Boiler Makers' Association.



Flanged staybolt hole on C. & O. locomotives

EDITORIALS

What Do You Want to Know?

In the United States today there are in the neighborhood of 200 Diesel-powered streamlined trains, rail cars and locomotives. Every one of these constitutes a problem for someone in the railroad mechanical department that cannot always be solved by the experience gained by many years of association with steam power.

With the idea of serving our readers who may want to know things about Diesel power but who have no specific place to go for the answer the *Railway Mechanical Engineer* introduced into the December, 1935, issue a column of "Questions and Answers." From letters we have received it is apparent that many of our readers would like to see such a column continued. Therefore, in order to provide some incentive for readers to jot down the questions which come to mind and send them in, we are offering the payment of one dollar ($1.00) for each question on this subject which is accepted for publication. The questions should be mailed to the office of publication, 30 Church Street, New York.

Turbine Locomotive Given Another Chance

The steam turbine has shown itself to be such a highly efficient prime mover in the stationary and marine fields it was but natural that locomotive designers should endeavor to employ it also in their field. During the past fifteen years the turbo-locomotive has not only been given a theoretical consideration, but a number of such locomotives have been built in Italy, Switzerland, Germany, Sweden and England which were known by the name of their proponents—Belluzzo, Zoelly, Krupp, Ljungstrom and others. Most of them were described in earlier issues of the *Railway Mechanical Engineer*.

The thought of high efficiency, commonly associated with the steam turbine, is obtained only under certain limiting conditions. A constant and suitably high rotative speed must be employed, a high exhaust vacuum must be attained, and the unit must be of a relatively large size. Its starting torque, at least in most designs, is low and it is non-reversing so that its best performance is under conditions where long runs can be made without shut downs. Moreover, if the power is to be taken off at a rotative speed less than that of the turbine spindle, a reduction gear must be employed. Fortunately, it has a large capacity for its weight and the space occupied, while reduction gears have reached such a high degree of development that they are now a minor problem.

Due to the restrictions mentioned the application of a steam turbine in place of a reciprocating engine to a locomotive has presented a difficult problem. Most of those who tackled the problem were, naturally, men experienced in the stationary field. In their endeavors to improve the efficiency of the locomotive they, naturally, sought to incorporate in it various devices, such as condensers, feedwater heaters and pumps, air preheaters and exhaust fans. Of these auxiliaries the working out of successful designs for condensers and exhaust fans proved to be extremely difficult. Condensers with air-cooled, as well as water-cooled, surfaces were tried. They were complicated, expensive and of varying capacity, dependent upon weather conditions. Moreover, available tender space was limited. As a consequence of high initial costs, increased complications and added maintenance expenses, considerably in excess of any demonstrated savings in fuel and water, most practical railroad men lost interest and the turbo-locomotive failed to become more than a fascinating engineering problem. It is of considerable interest, however, that a few of the more recent turbo-locomotives constructed were of the non-condensing type. These gained in simplicity, although they were somewhat less efficient.

At this discouraging stage the mechanical officers of one of the most important and progressive of the British railroads became convinced that the time had not yet arrived for pronouncing the turbo-locomotive a failure. They, therefore, attacked the problem of designing a turbo-locomotive which would be as simple as possible and yet permit the realization of a large portion of the turbine's efficiency. The result of these efforts is the London, Midland & Scottish locomotive described elsewhere in this issue.

This is a railroad man's idea of a clean-cut locomotive with no more departure from good standard practice than was required to apply a turbine in the place of a reciprocating engine. In working out the design, however, the accumulated knowledge of an experienced staff of a turbine and reduction gear manufacturer was utilized. In boiler, running gear and many details the locomotive is a duplicate of the latest and most successful 4-6-2 type standard locomotives built by this railroad. As a consequence, the results obtained in service will be fully comparable. It will be noted from the description that the locomotive is non-condensing, easily and efficiently controlled, and that an extremely ingenious front end has been worked out which it is an-

ticipated will make the resort to an exhaust fan unnecessary. The anticipated fuel economy is reputed to be 15 per cent which, if realized, would amount to a considerable reduction in operating costs in a country where current costs of coal may be taken as approximately $4.25 per ton.

Alloy Steels and Light Weight

The marketing of low alloy structural steels for use as a means to reduce dead weight and increase the life of railway rolling stock is a development which the railroads have sought for several years. During that time the steel manufacturers were encouraged, even urged, to produce a structural material of greater strength than carbon steel, which would not depend for its improved physical properties on special heat-treating processes, in order that the growth in the burden of dead weight in railway equipment could be checked and reversed.

The producers of structural steel have, in general, been interested in producing a low-priced tonnage product. The laboratories, of which there are no lack in the industry, have been for many years devoting themselves mostly to the improvement of processes by which the cost of carbon-steel products could be reduced and the quality improved. The industry has not been noted for its interest in the development of new materials which would interfere with the established routine of its carbon-steel tonnage production.

During the last three or four years, however, this situation has changed and an active interest has become evident in the discovery and development of alloys which can be produced in quantity at commercially feasible prices. Such are the so-called intermediate steels which, in addition to their increased strength, possess materially greater resistance to corrosion.

Now that materials are offered to meet the desires of the railways for a reduction in dead weight, a number of freight cars have been built in which the new materials have been employed in the principal elements of the structure. The fact that the pound price of these materials is higher than that of the carbon steel which they replace has aroused widespread interest in the problem of determining the dollars and cents value of each ton of weight which may be removed from the tare weight of the cars. Several such formulas have been developed.

It is obvious that at some price per ton of saved weight the increased cost of the light-weight cars may be sufficient to offset the value of the reduced weight in terms of lower operating expenses. Considered by itself, however, no one will deny that a saving of three, four or five tons in freight-car tare weight will produce distinctly worth while reductions in operating expenses. Even though at the outset the price which must be paid for equipment so constructed may leave a questionable margin of return, it must not be overlooked that the possibility for the reduction of car prices to a point little, if any, above those which must now be paid for cars built of the customary carbon steel shapes and plates depends upon the volume in which the use of the new materials develops. Already new mills are being installed for the rolling of some of these new materials and changes in dies and other details in the technique of fabrication on the part of the builders will undoubtedly have their bearing in reducing construction costs, not to mention designs better suited to the new materials.

With the relatively narrow margin of increased cost per car by which several tons of tare weight can now be traded for revenue load, the railroads may go ahead with the employment of the new materials confident that the saving in weight in the equipment purchased over a four- or five-year period will add little, if anything to the average price per car unit.

Romance of Electrical Developments on Railroads

In these days of rapid development along technological lines we are inclined to take things too much for granted and to forget the simple conditions under which our grandparents lived. This is forcefully brought to mind by the fact that the Westinghouse Electric & Manufacturing Company celebrated its fiftieth anniversary early in the month of January. It was not until the latter part of the 80's that the first street railway electric trolley system was built. If we only go back as far as the beginning of the present century—three and a half decades, and within the memory of most of our readers—and review the applications of electricity on the steam railroads since that time, we can get some idea of the tremendous progress which has been made in even that brief period.

In the latter part of the last century the general lighting in railroad shops was by flickering arc lights; low-power, pendant, incandescent lights (yellow strings in bottles) were used at the benches and machines. The old oil torch was an essential part of the railway mechanic's equipment. It is said that people who lived in Pittsburgh for even a short time, before the smoke elimination campaign was effective, could be identified after death by the fact that an autopsy would show a marked discoloration of the lungs. It is interesting to surmise what an autopsy would show in the lungs of a railway mechanic who attempted to do close work in the locomotive erecting shop and enginehouse with the use of the old-fashioned, smoky oil torch. These conditions are in marked contrast to those of the present day, when special lighting fixtures

and devices are used throughout the shop and enginehouse, in order to add to the convenience and comfort of the workers and make possible more efficient production and more accurate work.

Portable electric tools were practically unknown and the dinky portable steam engine, with its unwieldy flexible shaft, was hauled around the shop and connected up to steam lines for driving a limited number of tools, including the cylinder boring bar. Today, all sorts of portable, electrically driven tools are available, which can readily be plugged in and operated anywhere in the shop. Electric cranes, hoists and trucks speed up the handling of material and parts.

At the beginning of the century experiments were being made in a limited way with the application of the motor to individual machine tool drives. Today, line shafting, with its countless unsightly belts and shifting devices, has been largely done away with. The application of the individual motor drive to machine tools focused attention on speeding up production and making the very best use of the new cutting steels which were beginning to come into use. Possibly the greatest gain from the application of the individual drive has been the fact that machine tools can be located in any position. This has made possible the speeding up of production, since operations can be scheduled in the proper sequence, with the least possible waste motion between the various operations.

Electric welding has revolutionized repair processes. Heat treating by the use of electrical furnaces has made possible the accurate tempering of tools, and has taken the guess out of the preparation of babbitt for bearings.

Improvements such as those noted have also almost completely revolutionized enginehouse practices and have made possible a number of important improvements which contributed materially to the better functioning of these terminals. The old-fashioned, slow, and inefficient turntable has been succeeded by the fast operating, substantial, modern motor-driven table.

Oil headlights and cab lights on the locomotive have been replaced with electric lights, which have contributed to the more convenient and efficient handling of the locomotives. The early applications of electricity to the operation of signals were looked at askance by the average railroader, and it did take considerable time to improve these devices so that they would function with reliability—today they are one of the most important and reliable factors in the efficient operation of our railroads.

Oil lights and gas lights have almost disappeared from our passenger cars, although at the beginning of the century electric car lighting was in its infancy and was being experimented with on a few cars, most of them business cars. Mechanical department officers of that period, if they are still alive, can still recall with fear and trembling their experiences with some of the officers upon whose business cars electric lighting apparatus was being tried out. Today, the use of electricity upon the most modern passenger cars leaves little to be desired in the way of reliability or of effective lighting. Moreover, electrical devices play a large part in most of the air-conditioning apparatus on passenger cars and on various other devices on passenger trains, including boilers, radio, etc.

At the beginning of the century the electrification of railroads entering New York City was being considered and there was a royal battle on between the exponents of the alternating and the direct-current systems. Those who attended the electrical meetings of the New York Railroad Club in those early days still chuckle as they recall the vehemence with which the speakers expressed themselves, the only agreement between the opposing factions in the electrical field being that the steam locomotive would disappear within a decade. Electrification of trunk line railroads has gone on over the years, where it could be utilized to distinct advantage, so that today we find a considerable number of such applications. But the steam locomotive is still carrying the brunt of the load. It is significant, however, that the year 1934 showed the completion of the Pennsylvania electrification from New York to Washington, thus making possible faster service of the heavy traffic trains which operate between those two cities.

We might go on at great length to compare conditions in the railroad offices of the year 1900, with those of today, in which electrical appliances of all sorts play such a large part. Space is not available, however, to explore into these other departments and into other phases of railroad operation. The electrical companies with their engineering and research departments, are to be warmly congratulated for their remarkable contribution to railway efficiency and economy in the few decades during which these applications of electricity to the railroads have been in process of development.

NEW BOOKS

POWERFUL 4-8-0 TYPE FRENCH LOCOMOTIVES. *By Andre Chapelon. Published by H. Dunod, 92 Rue Bonaparte (VI), Paris. 160 pages, 12 in. by 8⅜ in., paper binding. Price 34 fr. 20.*

This pamphlet, which is a reprint of articles which appeared in the Revue Generale de Chemins de Fer, contains a very complete description in French of these remarkable locomotives now in service on the Paris Orleans-Midi. Many illustrations and six large folded plates add to its value. The reasons for various details of the design, the results obtained in service, together with dynamometer car and other test data are given in detail by the author, who was responsible for the design. These locomotives are 4-cylinder compounds with poppet valves. By use of high steam pressure, high superheat and careful designing of steam and exhaust passages, together with a double exhaust system, a design was produced which has shown such high efficiency in operation as to attract world wide attention.

THE READER'S PAGE

Fitting Floating Rod Bushings

To the Editor:

I noticed in the October issue of the *Railway Mechanical Engineer* the report of the meeting of the International Railway General Foremen's Association. One general foreman, in discussing the fitting of floating rod bushings, said a good practice is to allow .003 in. per inch of diameter smaller than the stationary bushing and .0005 in. per inch of diameter larger than the pin. This would give, on a 13 in. diameter, an outside clearance of .039 in., and an inside clearance of .006 in., or .045 in. total clearance. I think this is too much clearance on the outside diameter and not enough on the inside diameter. I have followed a practice, which has given good results, of making the bushing .015 in. smaller than the rod fit and .015 in. larger than the pin fit on all sizes of floating bushings. I cannot remember having any bushing stick in the rod or onto the pin; they last a long time. We had one floating bushing that was applied on a Mountain type passenger engine on October 30, 1930, and was renewed October 30, 1935; of course, this bushing made a lot of miles in that time.

In fitting stationary cast-iron rod bushings for the floating bushing I make them .020 in. larger than the hole in the rods and bore them .007 in. to .010 in. taper and, when they are pressed into the rods, you have a straight round hole. If the general foreman should try my practice of making floating bushings, I don't believe he would have any rod knocks. I very much fear that .039 in. will cause a noticeable rod knock.

W. E. Howard.

A Plea for Separate Journal Boxes

To the Editor:

That the freight-car truck with journal boxes and side-frame cast integral is growing in popular favor is apparent from the large number of such trucks that are now in service. In fact, this type of truck appears to be universally used on the cars built in recent years.

It is recognized, of course, that with the integral frame some saving in maintenance expenses is no doubt realized because of the fewer truck details. For example, there are no box bolts, nuts, washers, etc., to worry about, the absence of which, some equipment officers contend, facilitates inspection in transportation yards and reduces replacement expenses. While all this may be true, the question arises, is this sufficient to justify the adoption of the integral frame?

Assuming that box-bolt maintenance is an item of expense, is it not a fact that this expense is nullified by the labor saving realized in the time consumed effecting wheel changes? It would be interesting indeed to ascertain why certain engineers favor the integral type frame. Of particular interest would be a discussion of such matters as the future disposition of integral frames where the journal-box ceilings and dust-guard wells are found worn; also the relative cost of wheel changes with integral and non-integral frames.

In this connection there is the question of economy to be considered respecting the use of serviceable second-hand journal boxes recovered from dismantled equipment with the non-integral type frame. It is this writer's observation that the non-integral frame of proper design has certain definite advantages which can not very well be overlooked. Upon a careful investigation it may be found that the economies claimed for the integral frame are over-emphasized.

A Car Man.

And He Reads the Railway Mechanical Engineer!

To the Editor:

Knowing not your curator of ornithological exhibits, I rush to you with my complaint. The *Railway Mechanical Engineer,* December, 1935, page 495, credits James Nichols with the finding of a nest of the golden plover —at Dubuque, Iowa, no less. 'Tis the first time in history, I believe, the golden plover has ever nested at Dubuque—and even the first time anywhere in the United States. Records indicate the golden plover regularly nests from Pt. Barrow along the Arctic coast to Melville Peninsula and probably west to Baffin Island, north to Melville and N. Devon Islands, and south to Ard Lake and Chesterfield Inlet. Rand-McNally places Dubuque far outside these limits.

And the tail of the golden plover (commonly known as Pluvialis dominica dominica) is usually considered to be brownish gray, indistinctly barred, and not yellow.

There's no chance for disagreement as to the streamlining of the chicks; birds (blunt at the front and tapering away) are among the originators of streamlining.

Yours in the interest of ornithological accuracy.

(Signed) X.

PS:—I've a hunch Mr. Nichols found the nest of the killdeer.

Romney, Hythe & Dymchurch Railway

To the Editor:

In his explanation of the cartoon printed on page 511 of your December number, Marinac says that "this little railroad . . . could lay a double track between the rails of a standard track." That is quite true, but it would not be possible to run trains simultaneously on a double line so laid, because the passenger cars of the R. H. & D. Railway are 3 ft. 6 in. wide overall.

Incidentally, Marinac's cartoon does not convey an adequate idea of the motive power of this railway. The two latest 4-6-2 type locomotives weigh 19,600 lb. in full working order, including tender. They are 5 ft. high, from rail to top of stack, and 28 ft. 5½ in. long overall. The earlier 4-6-2 and 4-8-2 type engines are only slightly smaller. Though the Ministry of Trans-

port prescribes a speed limit of 25 m.p.h. for this line, the steam locomotives have approached 40 m.p.h. on special occasions. The engineman is not exposed to the extent shown in the cartoon.

Wm. T. Hoecker.

Marinac vs. Mechanical Engineer

To the Editor:

Noting letter signed "Mechanical Engineer" in your issue of December, I think some of your readers may still be puzzled.

Which is the westbound rail of an eastbound track; or which is the eastbound rail of a westbound track?

Artists are customarily allowed rather large tolerances, but mechanical engineers in railway work usually are called upon to operate in precision.

Your readers probably know what Marinac meant, and some may know what "Mechanical Engineer" meant. Of the two, it would seem that the latter errs the most.

Executive.

Which Comes First— The Job or the Rule?

To the Editor:

When visiting at the house of a friend, I happened to pick up the October issue of the *Railway Mechanical Engineer* and, being an ex-subscriber and an old railroader "hoping for a pension," I reverted to my old habits and immediately turned to those always interesting pages of "letters to the editor."

On page 423 there is related an astonishing episode between a roundhouse foreman and his superintendent of motive power. After reading it I looked twice at the date on the cover, for it read more like a page from an old edition published about 1886 than one in the year 1935.

In my younger days there would have been no necessity for asking such a question as "What would you have done?" In fact there was only one way to answer it, and that was by the good old-fashioned method and may the best man win. It was always a survival of the fittest and neither mental nor physical superiority alone would suffice. It required a combination of both to keep on top. It would be of interest to me, and I am sure to other readers also, to know just how long that superintendent lasts.

Admitting that it is a dangerous procedure to allow the ruling against intoxication to be violated, it is my belief that the foreman used good judgment in reasoning that the job to be done was of more importance than the violation of a rule. Surely efficient transportation and duty to the public comes first with every railroad officer and, if by stretching a rule better service can be maintained, my idea is to stretch it to the limit.

How many of us would almost embrace the old-time boomer mechanic who had just dropped off a freight and was still shaky from a previous debauch. We knew it was against the rules to hire him, also that he would not be with us long, but what a help he was while with us!

But to stop reminiscing and deal with the subject; what about the wonderful organizations, co-operative movements and adjustment committees on our railroads we have read so much about? Have they gone the way of the boomer, too? Or is it that when these bouquets were handed out, the foremen were forgotten? I believe Mr. Superintendent would think twice before dealing in such an arbitrary manner with any of the organized trade groups, knowing that in an appeal it might show cause for criticism of him for allowing one or two other conditions to exist that the writer of the article describes.

Show me a successful roundhouse foreman who does not violate a rule, or, in railroad terms, "take a chance." Believe me, if he didn't, he would not be a foreman long. If I had been that superintendent, I never would have known, officially, anything about that particular incident and would have kept that foreman in mind for the first promotion vacated.

Old Timer.

What Would You Have Done?

To the Editor:

I would like to make a suggestion about the little enginehouse drama entitled, "What Would You Have Done," that was published in the October, 1935, number of the *Railway Mechanical Engineer*. There was also some comment on it in your December issue, page 517.

I imagine something like the following flashed through the S. M. P.'s mind after hearing Bill Jones' explanation. There must have been outstanding thoughts bursting through his consciousness:

"Loyalty! Co-operation! Understanding!"

Loyalty of the man who would come back on the job, knowing the danger of being discharged for being intoxicated, and yet knowing that his particular knowledge of that night's work was especially needed if the engine was to be finished on schedule.

Co-operation on Bill's part in shielding his man because it was his first offense, loyally trying to show his *understanding* and appreciation for the efforts this man used in his behalf.

It took but a few moments for these thoughts to fly through the S. M. P.'s head—the realization of the work accomplished by these men that went into the making of a big railroad organization—and he knew there were other men like Bill, who though handicapped from the loss of man-power, were still serving their railroad with the same unswerving loyalty.

So turning to Bill, the S. M. P. said: "Go back to your job, Bill. You are a better man than I, for you have taught me a lesson that I've needed to know."

And again those three words flashed through his mind: Loyalty! Co-operation! Understanding!

A Reader.

Perhaps Cars Will Be of Steel.—A 65-year-old copy of the Official Guide recently dug up contains the following prediction: "The time is not far distant, probably, when passenger cars will be made of iron or steel, and that without any increase of the non-paying weight. The iron car will have the advantage that it cannot be burned and the passengers cannot be transfixed with splinters in case of collision. There have already been one or two iron passenger cars built in this country, but they were crude in design and not looked upon favorably either by managers or by the public."

Gleanings *from the* Editor's Mail

The mails bring many interesting and pertinent comments to the Editor's desk during the course of a month. Here are a few that have strayed in during recent weeks.

Smash and Clash and Rattle

I have saved the article on ways and means of reducing noise around passenger cars (January, 1936, page 24). . . . One of the few remaining annoyances about travel in modern railroad cars is the disposition of the running gear to smash and clash and rattle sometimes.

Suggests Change in Seniority Rules

The seniority regulations should be changed to read: "Seniority shall prevail *only* when qualifications and merit are equal." This rule should be strictly enforced. In applying this, the management should be the judge, but the employees' representative must agree to the decision and give the employee the privilege of comparing qualifications in conference, if he so chooses.

Visiting Other Shops

I dare say there are lots of foremen in and around terminals where the company has main shops and nothing is being done in the way of giving these foremen an afternoon now and then to pay the shops a visit and see the construction work going on, be it pipe work, carpentry, upholstery, or whatever a man may be interested in, in general and particular. Moreover, I feel sure that the time is near at hand when railroads will have to demand a fairly high standard of education in their employees.

Our Efforts Fruitful

The officers and members of our association fully realize the excellent work done by you on behalf of the so-called minor mechanical organizations, and I am free to confess that without the stimulation of your wonderful magazine the load of caring for the association under the very trying conditions during the past five years would have proved too great and probably would have fallen by the wayside. We have already started our 1936 campaign for new members, working on topics that must be worth while in the eyes of our higher officials and be an incentive to them to send their men to the conventions.

"Pound Foolish" A Masterpiece

In regard to the "Walt Wyre" stories, which I say are not stories but something that is happening every day in the present-day life of a busy roundhouse; I did not think the first two could be improved upon, but "Pound Foolish" is a masterpiece. I often wonder if the "powers that be" realize the cost in time—which is money—that lack of necessary material is responsible for. I could quote a number of instances of serious delays and spoilage of perishables due to lack of foresight coupled with someone trying to cut down his monthly stock balance. How often have I tied up a lathe hand and his machine for a couple of hours machining a five-dollar finished product into something urgently needed, the net result being a great deal of scrap turnings and borings and a finished article that could be bought on the market for a dollar or less. But the power had to be furnished for a fast run. No alibi accepted.

Jim Evans of the S. P. & W.

I was also very much interested in the article ("Pound Foolish") on page 513 of the December, 1935, *Railway Mechanical Engineer,* about Roundhouse Foreman Jim Evans of the S. P. & W., at Plainsville. I think this is one of the most interesting pieces I have ever read in your magazine; I liked it so well that I read it over the second time and have written a letter to our general foreman asking him to request our storehouse officials and others who might be interested, to do likewise.

A Story You Can Tell

It may be thought that our mechanical employees are so far removed from contact with the general public that they can do little, if anything, in improving the public relations of the railroads. This is a great mistake. You are aware of the fact that the charge has been made that the railroads are not progressive, and that they are doing business in the same manner that they conducted it a quarter of a century ago. You and I know that the railroads have made tremendous strides in the matter of improving their service and in reducing the expenses of operation. I think it would be interesting to the average man to know the improvements that have been made in our railroad equipment, which have resulted in reducing the cost of operation and in added security to the movement of passengers and freight. We have effected a tremendous saving in the consumption of fuel, largely due to improved mechanical devices and to the intelligent use of fuel. Not many people know this, and I know of no one better qualified to tell the story than our mechanical department employees. This is just one of many things that the mechanical people have done that has improved our service, and it is a story that those who address public meetings could well tell.

* * *

For explanation see page 88.

With the

Car Foremen and Inspectors

Port Huron Car Shop Kinks

IMPORTANT improvements in the Grand Trunk Western freight-car repair shops, Port Huron, Mich., include a recently rebuilt shop building, modern crane and other facilities for expediting car repairs, and a shop force organized to handle this work as well as heavy rebuilding operations on an efficient basis. A comprehensive article covering the Port Huron shop improvements and general method of operation will be published in an early issue of *Railway Mechanical Engineer,* the present article being devoted to a description of a few of the numerous car shop kinks and labor-saving devices which have been such an important factor in increasing shop output and reducing unit costs.

Sandblast Shed

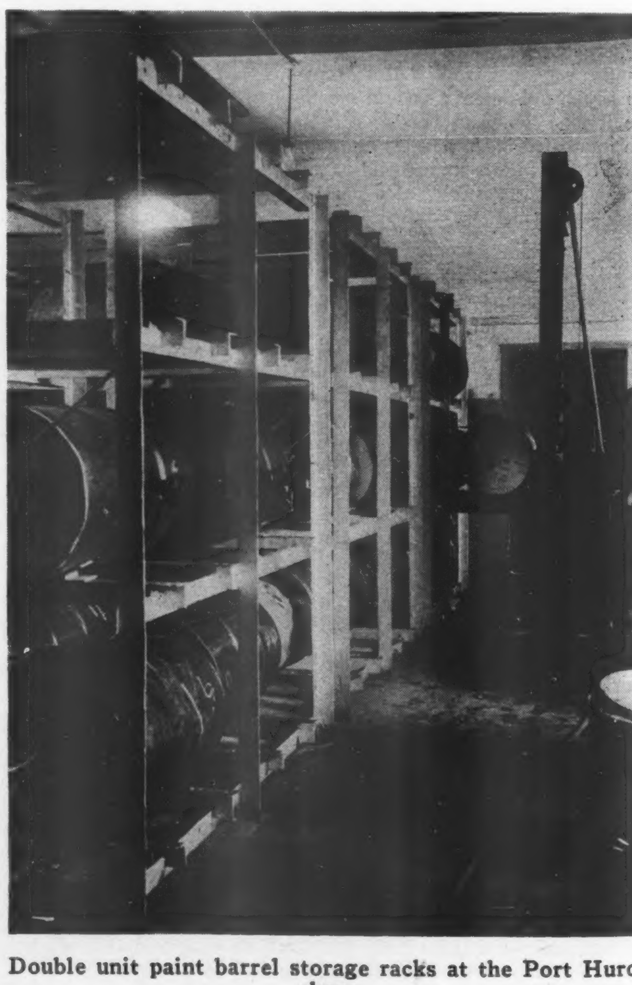
One of the features strongly emphasized at Port Huron shops is doing a first-class paint job, especially on steel equipment; and in many instances this requires sandblasting in order to remove all rust and mill scale and get down to the base metal. The sandblast shed has proved an important factor in enabling this work to be done satisfactorily and at minimum cost in all kinds of weather.

New sandblast shed at G. T. W. car shops, Port Huron, Mich.

The shed was constructed as part of the shop improvement program, and is located on a spur track extension northwest of the main shop buildings. The shed is 28 ft. wide by 127 ft. long by 16 ft. high, being constructed in the main of 3-in. by 3½-in. scrap angles, with galvanized iron roof sheets applied over 2-in. by 6-in. purlins and side sheets extending downward only about 5 ft. The supporting posts are spaced on 16-ft. centers and the sides left open during normal operation on fair, quiet days. During inclement weather or on windy days, the No. 8 duck canvas curtains can be pulled out along their supporting wires to cover the open sides of the shed and furnish adequate protection to the sandblast operators as well as increase the effectiveness of their work and prevent the loss of sand out of the building.

The forward end of the sandblast shed is entirely uncovered. The rear end, made of galvanized iron, is provided with an opening large enough to permit entrance of the sand-storage car shown in outline in the illustration. The usual white, dry, silica sand is used, being dumped into the hopper of a sandblast machine in the rear of the shed. From this machine the sand is delivered under shop line air pressure through special Goodrich sandblast hose and suitable nozzles to the car sides or to the parts which are to be cleaned. The sandblast hose is designed for this particular service, being made of special rubber 1⅞ in. in outside diameter and ⅞ in. in inside diameter, and having a very satisfactory service life. The nozzle, known as the Borium S-B type, has an outside diameter of 1⅛ in., inside diameter ½ in. and length 2¾ in., being guaranteed for 300 hours' service life, and frequently lasting as much as 600 hours.

New sand, delivered under an air pressure of 110 lb., is used in removing the enamel finishes from passenger cars, and older sand at 90 to 100 lb. pressure is usually



Double unit paint barrel storage racks at the Port Huron shops

adequate for removing rust and mill scale from freight equipment. All sand is used over again to a maximum of about five times before its cutting qualities are lost. Re-used sand sometimes picks up a certain amount of moisture from the atmosphere and the shed floor and has to be strained and dried in a special drier provided in the rear of the sandblast shed.

Storing Paint Barrels

For a number of years the Port Huron shops have been provided with a modern fireproof paint-storage house with unusually good facilities for handling paint materials and delivering them to the passenger and freight car paint shop forces, as required. An accurate check of the quantities of paint used is obtained and considerable economy has been effected in arranging to have all paint brushes, spray painting equipment, etc., turned in to the paint house for proper care and attention at the close of each day's work.

A feature of the paint house is the provision of substantial steel paint-barrel storage racks and a lift truck, as shown in one of the illustrations. The paint house is equipped with a total of four of these double-unit, four-tier racks, each of which has a capacity to hold 40 barrels of paint. A large increase in paint storage capacity is thus secured without taking up additional floor space.

The double-unit storage racks are 7 ft. wide, 9 ft. deep, 9 ft. high at the front and 8 ft. 10 in. high at the back, to provide a slight incline which will prevent barrels from rolling out of the rack. As an extra precaution, however, two metal stops are inserted under each of the outer barrels, being provided with projecting lugs on the bottom to fit suitable holes in the supporting angle irons. The storage racks are made of scrap 3½-in. angles, keyed and riveted together, as illustrated. The vertical supports are set in the concrete floor and the entire frame work is rigidly secured to the back wall of the paint house. The horizontal parallel supporting angles are locked in place without rivets by a construction also shown in the illustration. Diagonal tie rods, made of ⅝-in. steel, are installed, as shown, and serve to stiffen the frame work and hold it in position under the heavy loads sometimes imposed on it.

Equipment used in stenciling a car by the spray method

The Barrett portable elevating truck, illustrated, furnishes a convenient means for placing barrels in or removing them from the storage racks. This truck has a total lift of 12 ft. and can be operated either by hand or air motor. A friction lowering device makes it easy to lower barrels from any tier-level to the floor.

Spray Stenciling

A number of railroads are using the spray method of stenciling successfully, but others have not secured the desired results. The principal requirements for success are the use of reliable paint-spray equipment with an air pressure suited to the paint material being used and a stencil which is sufficiently flexible to be fitted snugly against the sheet.

The way this operation is performed at the Port Huron shops is shown in one of the illustrations. The particular spray gun illustrated is the Thor, model No. 6, furnished by the Binks Manufacturing Company, Chicago. The regulator, furnished by the DeVilbiss Company, Toledo, Ohio, is used to reduce the shop-line air pressure from 95 lb. to 35 lb. at the spray gun when a heavy stencil paste is used. For lighter materials, the pressure is reduced still more. The type of stencil is clearly shown in the illustration.

Special jig used in renewing worn brake-beam heads

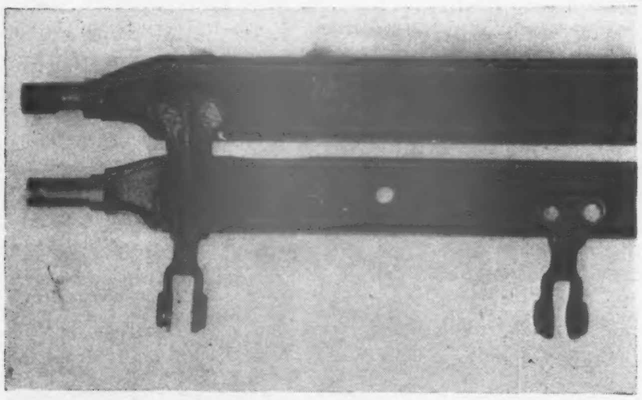
The advantages of spray stenciling, as developed by experience on the Grand Trunk Western and other roads, include neater lettering than was formerly secured, less paint material required, greater speed in stenciling, less frequent cleaning of stencil backs required, and longer stencil life.

Brake Beam Repairs

A.A.R.-Type brake beams with worn heads, but having tension and compression members in good condition, are repaired at the Port Huron shops by means of the special jig and ratchet wrench shown in the illustration. The nut is removed from one end of the brake beam only, using the ratchet wrench illustrated and as much leverage as may be required to turn off the nut. The channel is held in two stationary angle clamps on the jig and the strut end in a movable clamp which can be adjusted to suit brake beams of different style or size. The worn brake heads are removed and new heads applied over the tension rod, the brake beam being reassembled and a new nut applied and tightened until the required tension is secured. The end of the rod is then headed over, in accordance with recommended practice. Slightly worn brake heads are mated and reapplied for use on certain classes of G. T. W. cars, new heads being used on all system cars.

The method of reclaiming Simplex brake beams with

worn ends consists of reforging each defective end, after welding in a piece of steel large enough to make up for all wear. The ends are drawn out to 1½ in. in diameter and then upset in a forging machine to $\frac{1}{16}$ in. oversize. The brake beam ends are recentered and turned in an engine lathe to the original diameter and length, after which new cotter pin holes are drilled. This gives a brake beam practically as good as new, and the fact that the ends have been turned on lathe centers assures that they will be in line, an important requirement not always met where the attempt is made to forge



Simplex brake-beam end before and after being reconditioned

the ends directly to finish size. Obviously, unless the brake beam ends are in line and accurately fitted to the heads, uneven and excessive wear of brake shoes and heads will result.

Applying Siding-Draft Gears

The simple use of turnbuckle jacks in applying new side planks to steel frame box cars is shown in one of the illustrations. The upper turnbuckle screw, or swivel, in each case carries a small metal square which bears

Use of turnbuckles in applying new side planks to a car

against the grooved edge of the upper plank. The lower turnbuckle screw in each case is welded or riveted to a U-shaped piece of sheet metal which carries a hardwood block, grooved to fit over the tongue of the lower plank. After all side planks are applied except two or possibly three, as shown, and due precautions are taken to prevent the planks from springing out away from the frame, operation of the turnbuckles by means of a small hand bar compresses the planks the required amount so that the joints will not open up due to shrinkage when the car is placed in service. When the desired compression is secured, the bolt holes are bored from the inside and the bolts applied. The remaining side planks are driven home, drilled and bolted, thus completing the job.

A four-wheel elevating platform truck, useful for many kinds of work about a car shop, is illustrated. It is used primarily for transporting storage batteries between cars

Elevating platform truck used in applying couplers

and the battery shop and also for transporting couplers and draft gears and raising them into position under the car. The platform, normally supported on the truck frame, is capable of being raised by means of four small screw jacks bolted to the frame, one at each corner, and arranged to be operated by a single handle at the front of the truck through suitable bevel gears and a short extension shaft. The lift of the platform is arranged to suit the usual elevation of passenger car battery boxes as well as that of work benches in the battery shop. In removing and reapplying couplers and draft gears, this truck is not only a labor-saving device but an important safety feature, as it avoids the necessity of dangerous blocking. For best results, the wheels of the truck should have roller bearings and the elevating screws be well lubricated, thus assuring easy operation.

Reconditioning Seat Cushions

One of the illustrations shows a satisfactory method of reconditioning passenger car seat cushions which have

Passenger-seat cushion before and after being reconditioned

become badly worn on account of passengers resting their feet on the edges. The pile is completely worn off the plush at the front edge of the cushion, as shown,

and no amount of cleaning or renovating would make the plush suitable for reapplication to the cushion as it was put on in the first place. The plush is removed from such cushions, thoroughly cleaned, worn parts cut off, and joined by sewing to a similar piece of plush from another seat cushion. The sewed piece of plush is then applied to a reconditioned cushion with the seam

Double-deck stock car rebuilt at Port Huron shops

Interior lower deck view of the stock car showing movable bulkhead for converting from 40-ft. to 36-ft. compartment

at the middle of the cushion, as shown in the upper part of the illustration. It requires the plush from two old cushions to form the renovated covering for one cushion, as described.

Converted Stock Car

One of the illustrations shows a G. T. W. double-deck stock car which is one of 50 recently converted at Port Huron shops from an old type of automobile box car. The new stock car has a nominal capacity of 85,000 lb., load limit of 87,500 lb. and light-weight of 48,500 lb. The car is 40 ft. long and has a total inside height of 9 ft. An interesting feature is the provision of a vertical strip of wood near one end of the car, painted with alternate white rectangles corresponding to the side board widths and red rectangles corresponding to the spaces between boards. This gage gives a check of proper board spacing and also shows a free height of 49 in. in each deck.

Another interesting detail in the design of this car is the provision of a movable partition at one end of each deck, by means of which a shipper who asks for a 36-ft. car can be provided with compartments of exactly that length and not be compelled to load and pay for a longer car than actually needed. These movable partitions are suspended from double tracks and positioned by means of three 1¼-in. bolts, illustrated, which fit into suitable metal sockets set in the car decks.

Outfit for Handling Freon Containers

ON passenger cars that are equipped with the Freon system of air conditioning it is sometimes necessary to replenish the supply of freon. The loss of freon is generally due either to leaks in the copper tubing or to broken tubes resulting from vibration or due to being struck by objects in terminals. Freon is furnished in containers, smaller, but of similar appearance to the conventional oxygen cylinders. The handling of these cylinders in the terminal coach yard or at passenger stations can be simplified by the use of a two-wheeled wagon such as shown in the illustration.

The handle and frame of the truck is constructed from 1½-in. wrought iron pipe to which is welded pieces of 1¼-in. flat iron straps which serve to secure the container to the cart. The wheels are mounted on a 2-in. axle and are equipped with roller bearings to facilitate the handling of the outfit by one man.

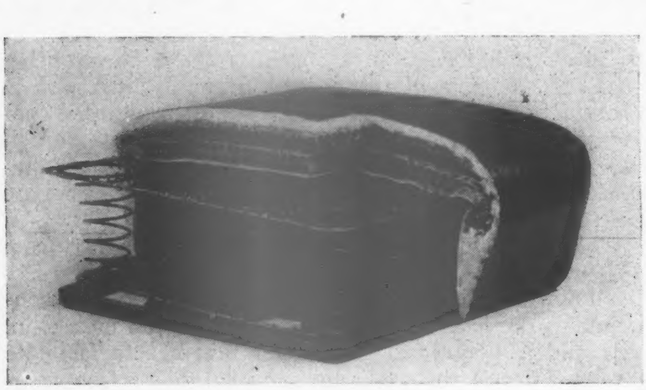
This simple two-wheel truck simplifies the handling of Freon containers

Latex Upholstery Material

A NEW upholstery material, using Latex and a unique method of fabrication, is announced by the B. F. Goodrich Company, Akron, Ohio. Known as Nukraft, this material, it is claimed, offers many advantages as a spring decking in the construction of railway car seats.

It consists of hair cloth, insulated with Latex, which has been fabricated into loops forming a structure of figure eight springs. The resulting material is soft, buoyant, and elastic, yet has sufficient structural strength to bridge the open spaces between the springs, presenting a smooth, comfortable surface through which the springs will not protrude.

Nukraft is applied in two-ply thickness directly over the burlap or canvas covered spring unit, a thin layer of cotton is placed on top and the cushion is then ready for covering. Nukraft locks the cotton in place and prevents it from shifting and bunching and makes for a permanently smooth surface through which the springs cannot be detected. This construction assures the proper ventilation necessary to seating comfort because of its fabrication in loops which permits a continuous air circulation regardless of the amount of pressure applied.



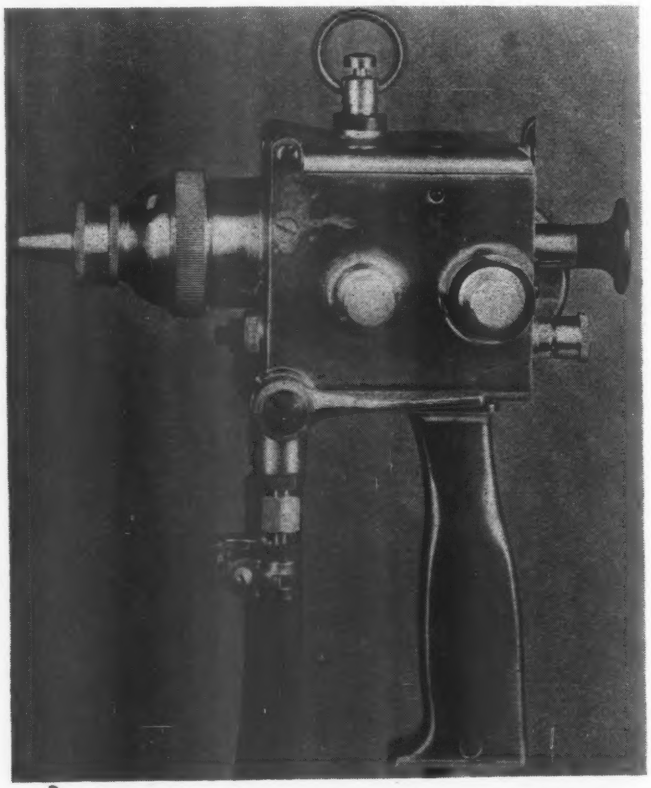
Section of seat cushion showing Latex woven into a figure-eight structure to bridge the springs

Metal Spray Unit

A NEW metal spray unit, known as the "Mogul," has recently been developed by the Metallizing Company of America, Los Angeles, Cal., and is being distributed by the Metallizing Engineering Company, Inc., with offices in New York and Chicago. This new unit, made by the same company which produced the original "Metallizer gun," incorporates certain improved features rendering the new design adaptable to unusually severe operating conditions in metal spraying service.

Primarily, the metal spray gun is intended for mounting in the tool post of a lathe to be used for machine element coating and for that reason no particular effort has been made in the design to keep the weight at a minimum. Nevertheless, it is not too heavy to be used as a portable tool and will be available for that purpose as well as a lathe tool.

One feature worthy of note is that the wire-feed mechanism and gas head, while attached to each other, are, in reality, separate units. This departure from the usual design reduces the replacement cost in case either assembly is damaged, and, furthermore, permits a better combination of metals being used for the construction of these parts. Moreover, the complete separation of the gas head and wire-feed mechanism is an insurance against combustible gas mixtures working back into the enclosed gear case through gas-mixing channels drilled in the gear case proper.



"Mogul" metal spray unit designed for severe service conditions

The wire-feed unit is self-contained, and all the worms and gear-shafts are mounted on annular ball bearings. These assemblies run in a bath of fluid grease and are completely enclosed in a dust-proof case. The use of annular bearings insures permanent alinement of the worms and gears and reduces wear on these parts to a minimum. The turbine has surplus power and runs at a slower speed than is ordinarily found in equipment of this type, thus maintaining a steady flow of power without continual adjustment.

The various parts of this unit, designed with a full appreciation of the service to which they will be subjected, are made of carefully selected materials. The gas head is a bronze casting, and the simultaneous control valve is of hard bronze. Excellent wearing qualities are assured through the use of this combination of materials and the valve is designed to need little attention. The gas and oxygen mixing is done in a metering tube so constructed that there is little likelihood of flash back down the oxygen hose. A hardened steel wire guide tube is incorporated in the assembly so as to reduce wire wear in the parts of the front end.

The thought behind the "Mogul" has been to produce a metal-spray unit which would stand up under severe service. The new gun does not replace the "Metallizer gun" but is a high-power, hard-built production tool, Model A being available for the production spraying of

steels, monel and nickle, and Model B for spraying aluminum, bronzes, copper and brass.

In the railway field, as well as in general industry, the "Mogul" metal spray gun is used largely as a maintenance tool, providing an economical method for restoring worn armature shafts, rods, and other similar parts to their original size. In addition, non-corrosive coatings can be applied as needed. The process has been used successfully for building up innumerable worn locomotive parts, such as pins, bushings, links and link bars, air brake valve parts, piston rods and throttles, feedwater pump rods and castings. One of the important potential uses of the metal spray gun is in the application of protective coatings, as mentioned. For example it has been used for applying a zinc coating to passenger car platforms, steps, window jams, sills, the lower part of toilet room walls and dining car kitchens. Battery boxes have been coated with lead and the insides of tank cars and water tenders with zinc. Considerable success has also been attained in coating with zinc the water side of fireboxes and boiler tubes as a protection against pitting.

Paint Cleaner And Protector

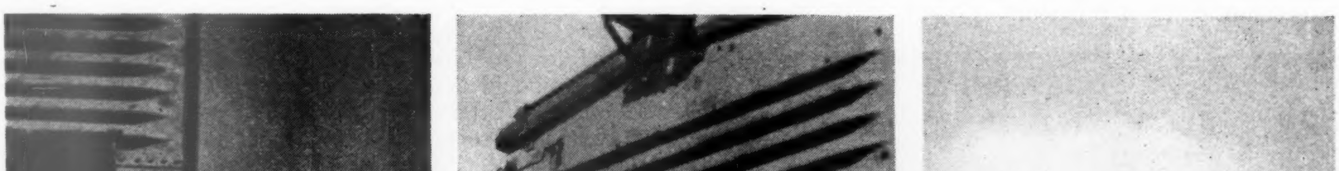
A NEW method of restoring old paint on passenger and freight cars and then protecting the surface so as to extend its life has been developed by the Gregg Company, 1418 Walnut St., Philadelphia, Pa.

On equipment which has been in service for some time and on which the painted surface has acquired a coating of grime and dirt, the paint is first washed with clear water, using a hose, and then brush scrubbed with a solution of "Drion" car cleaner. This loosens and dissolves the coating of dirt without injury to the paint itself. After a section has been cleaned it is again washed off with clear water, applied by a hose. The surface is then coated with Drion triple-life finishing solution, applied, if desired, by a cotton mop dipped in the solution. Even better results are claimed by spraying on the finishing protective coating. This finish is said to dry quickly, leaving a colorless, air-tight and hard, yet flexible, coating which retains its elasticity for an extended period of time. After this coating has been applied the surface can usually be cleaned by a dry mop only.

On newly painted equipment, after the surface is dry, the application of a coating of Drion triple-life finish is recommended before the car is placed in service.

Portable Sand Blast Machine

THE illustration shows a portable sandblast machine which is being used at the Great Northern car shops, St. Cloud, Minn., for sandblasting steel ends and steel underframes on freight cars requiring general repairs. The tank, 21 in. by 26 in., and tested to 150 lb. pressure, is mounted on a three-wheel carriage. The vital mechanism of this machine is the mixing chamber, made of a section of 3-in. pipe, 56 in. long and reduced at each end to 1 in. by welded plugs into the pipe. The



Portable sandblast machine and equipment, including glass-faced operator's hood, used at St. Cloud shops of the Great Northern

air pressure enters the chamber at the left end, as shown in the illustrations. A ½-in. air pipe also leads into the top of the tank, and a small ½-in. valve is placed in the ½-in. pipe to regulate the air. A 2-in. connection is welded into the top of the tank for filling. A 1¼ in. cut-out valve connects the bottom of the tank with the mixing chamber. By the use of this valve, the amount of sand delivered is regulated. A heavy-duty hose is attached to the other end (right end of chamber). A cast iron plug is fitted into the end of the hose, and a 7/16-in. hole drilled through this plug. If desired, the hole can be threaded and a short nipple screwed into it. However, the use of a hose with the plug provides a flexible end which is generally preferable.

The illustrations show a 50-ft. automobile car with steel end partially blasted. The dimensions of the car end are approximately 10 ft. high by 9 ft. 6 in. wide, the average time consumed for sand-blasting with this machine being 20 minutes.

One of the illustrations shows the hood worn by the operator of this sandblast machine, the unique feature of this hood being that the glass dial of approximately 7 in. or 8 in. diameter which is fastened into a steel ring and can be easily removed when it gets pitted.

Portable Lubrication Cart

THE lubrication outfit shown in the illustration is used by passenger terminal maintenance forces in connection with the lubrication and daily adjustment of air conditioning equipment.

Cart for air-conditioning maintainers holds lubricants and tools

Heavy lubricant is provided in one of the two containers for use in gear boxes while the other container is filled with grease suitable for application to fittings on generator, pump and compressor bearings. In addition to the two lubrication containers the cart is provided with a receptacle of sufficient capacity to carry the various wrenches and other tools that may be needed in connection with the maintenance of air conditioning equipment.

The cart is mounted on two 18-in. wheels equipped with roller bearings. The tool container is made from ¼-in. copper-bearing steel sheets which may either be riveted or welded together. The handle is made from 1¼-in. wrought iron pipe.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Repairs Claimed Excessive And Unwarranted

Five G. M. & N. cars and 3 N. O. G. N. cars were repaired by the New Orleans Public Belt Railroad and charges included in regular monthly bills. The Gulf, Mobile & Northern took exceptions to charges, claiming extensive repairs had been made in violation of Rule 1, paragraph (b). The N. O. P. B. claimed repairs made were the minimum necessary for safety of lading and trainmen. Case was appealed.

The G. M. & N. claimed that the N. O. P. B. had made unwarranted repairs in violation of Rule 1, paragraph (b). A statement was submitted showing bills for the eight cars totaling $225.69, ranging from $10.13 to $57.28 per car. The N. O. P. B. is a switching road with whom they made connections at New Orleans.

The N. O. P. B., in analyzing bills, stated that none of the cars was subject to disposition under Rule 120. It was contended that a similar case was covered by Arbitration cases 1033 and 1094, and that repairs were within scope of Rule 16 and not in violation of Rule 1, paragraph (b). The majority of G. M. & N. cars were afterwards loaded on their line with various commodities. It was stated that they were compelled to make repairs to foreign cars in order to meet demands for first-class equipment and that it would be bad policy to subject industries to delay caused by lack of suitable equipment. It would be difficult to handle requests for empty cars, preparing only certain cars and making only certain classes of repairs. The N. O. P. B. serves many industries and, in the first ten months of 1931, 26,420 cars were loaded, of which 1,054 were delivered to the G. M. & N. During the period less than 100 G. M. & N. cars were repaired. Foreign cars returned to G. M. & N. under load greatly exceeds G. M. &.N. ownership repaired on their line and returned. Repairs in question included brake beams, decking, side doors, lining and roof boards. Repairs were considered necessary for

safety of lading and trainmen and it was felt they were justified in making them.

In a decision rendered April 11, 1935, the Arbitration Committee said: "The repairs in question do not exceed the minimum necessary for safety of car, lading and trainmen, as provided in Rules 1 and 16. Therefore, claim of the Gulf, Mobile & Northern is not sustained." *—Case No. 1741, Rules 1 and 16, Gulf, Mobile & Northern vs. New Orleans Public Belt Railroad.*

Improper Repairs on Basis of Billing Repair Cards Covering Control Valve

The Chicago, Rock Island and Pacific cleaned the air brakes on S. P. baggage car 6446, February 15, 1932, at Chicago and issued billing repair card showing U-12-B type U. C. control valve removed and applied. The Rock Island again cleaned the brakes on the same car December 9, 1932, and, as shown on billing repair card, a U-12 type U. C. control valve was removed and applied. The Southern Pacific matched the two C. R. I. & P. billing repair cards and forwarded documents to the latter road requesting adjustment of overcharge in amount of $85.00. C. R. I. & P. maintains that subsequent billing repair card cannot be considered valid as joint evidence if car has been on home line during interval between first and subsequent repairs and demanded evidence of wrong repair per Rule 12. The S. P. claimed this was unnecessary, as C. R. I. & P. billing repair cards in themselves constitute joint evidence. Failing to agree the case was appealed.

The Southern Pacific in its statement said that the question at issue is whether or not the two C. R. I. & P. billing repair cards issued in February and December covering air brake work on S. P. car 6446 served as joint evidence of wrong repairs. It was evident that these were conclusive evidence of wrong repairs in December as previous card showed car equipped with U-12-B valve at that time and that in accordance with item 20-C of passenger Rule 21, a credit of $85.00 is due.

The C. R. I. & P. in its statement called attention to care taken by repairs forces at Chicago and maintained that a U-12 valve could not have been substituted for a U-12-B valve in December and that they must refuse responsibility and expense of wrong repairs without the submission of joint evidence by owner in accordance with Rule 12. The car referred to was delivered by C. R. I. & P. to S. P. in interchange service six times between February 17, 1932, and December 11, 1932, and received back from S. P. five times. The car was not on line of C. R. I. & P. between May 8 and December 8 when air brakes were repaired a second time on December 9. It was contended that C. R. I. & P. position was supported by Arbitration Decisions 1381 and 1709.

In a decision rendered April 11, 1935, the Arbitration Committee said, "Car owner failed to obtain joint evidence within 90 days after first receipt of car home as required by Rule 12. The contention of the Southern Pacific is not sustained."*—Case No. 1742, Rules 12 and 90, Southern Pacific vs. Chicago, Rock Island & Pacific.*

Transfer of Lading—Expense of Cleaning Tank Included

E. R. I. X. tank car 610, loaded with fuel oil, was received from the Santa Fe at Ponca City, moved to Kansas City and delivered to Union Pacific, being destined for Omaha. On arrival at U. P. yards at Kansas City an inspector of the Kansas City Car Interchange Bureau reported car in bad order account outlet pipe broken off and cap missing and leaking at outlet valve. Authority was issued to U. P. for cost of transferring load. The U. P. intercepted C. H. I. X. car 8416, previously loaded with kerosene, into which to transfer the fuel oil and agreed to pay the cost of cleaning after car was unloaded, to make it suitable for the same commodity with which it was previously loaded.

The C. R. I. & P. in its statement said that the U. P. in rendering bill on authority of a transfer card included a charge for $18.00, the cost of cleaning C. H. I. X. car 8416 after the fuel oil was unloaded, claiming expense to be a proper charge against delivering line per arbitration decision 1440. C. R. I. & P. contended that U. P. made no diligent effort to locate a suitable car into which to make the transfer, but intercepted the first available car, which happened to be clean, rather than pick out a fuel car from those passing through Kansas City daily in large numbers, and therefore, declined to pay the cost of cleaning. In Case 1440 it was shown that the V. S. & P. endeavored for several days to locate a suitable car and being unable to do so secured a car with the understanding that it would be cleaned afterwards and restored to its original condition. In the present case apparently no effort was made to find a suitable car because the entire transaction of picking up the car and making the transfer consumed only 4 hr. and 15 min. It is, therefore, contended that decision in case 1440 is not parallel and that the cost of cleaning is not a proper charge against the C. R. I. & P.

The Union Pacific in its statement said that E. R. I. X. car 601 was entitled to best movement possible. Immediately after it was found leaking and marked for transfer, a check was made of U. P. yards to locate a tank car of similar capacity which had last contained a commodity that would permit its use without prior or subsequent cleaning. No suitable car being available, arrangements were made to use C. H. I. X. car 8416, with the understanding that this was a clean car in kerosene service and U. P. would accept bill for cleaning when car was released. In rendering its bill the U. P. included $18.00 for cleaning as part of cost of transfer and maintains that procedure was supported by decision in case 1440. E. R. I. X. car 601 was delivered to U. P. by C. R. I. & P. at 12:15 P. M. April 6, 1933 and scheduled to move out of Kansas City over U. P. at 5:00 P. M. the same day. Search for a suitable car required approximately 3 hr. leaving only 2 hr. to effect transfer and switch car into scheduled train. Referring to contention by C. R. I. & P. that the U. P. finding it had no suitable car should have called upon the Rock Island, or some other connecting line for a suitable car, it was stated that the Rock Island could not have furnished a car in time to avoid delay for the reason that the next regular delivery from Rock Island to Union Pacific was scheduled at 11:00 P. M., and also that even if a suitable car had been found, as only 2 hr. remained in which to make a transfer, the C. R. I. & P. could not have furnished a car in time to maintain scheduled movement of load, even if such a car had been found available. In order to avoid delay the U. P. had no other recourse than to use a car that would require cleaning after release.

In a decision rendered April 11, 1935, the Arbitration Committee said: "The position of the Union Pacific is sustained. Decision No. 1440 is parallel." *Case No. 1744, Rule 2, Chicago, Rock Island & Pacific vs. Union Pacific.*

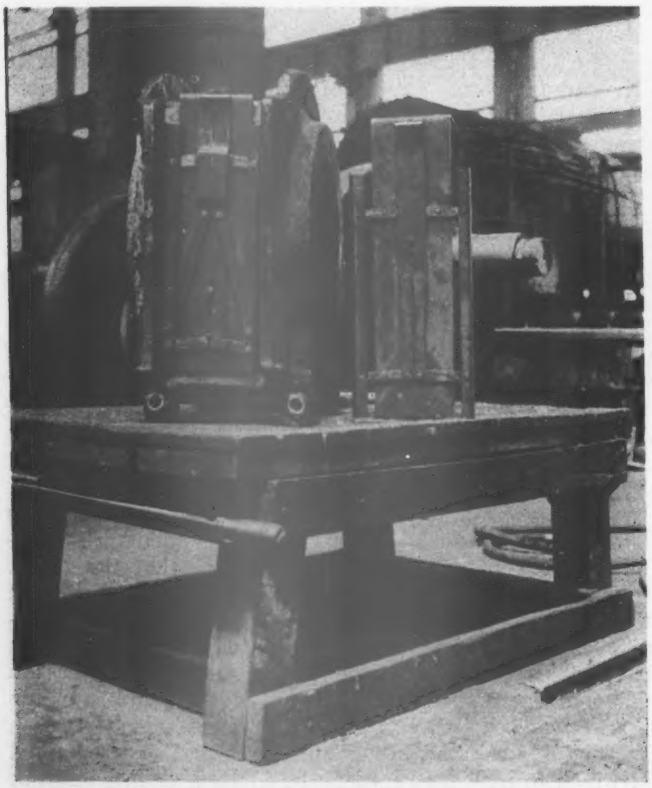
In the Back Shop and Enginehouse

Labor Saving Devices at Albuquerque Shops

A NUMBER of relatively simple but effective devices for saving labor at the locomotive shops of the Atchison, Topeka & Santa Fe, Albuquerque, N. M., are shown in the illustrations. In general, these devices are neither complicated nor expensive to make, and they are typical of the many ingenious gages, test racks, work-holding fixtures and material-handling devices which railway shop men have developed in recent years to assist them in maintaining production with reduced working time.

Checking Driving-Box Saddle Seats

A special gage for checking the frame clearance of driving-box saddles and making sure that the saddle seats are properly squared is shown in the illustration.



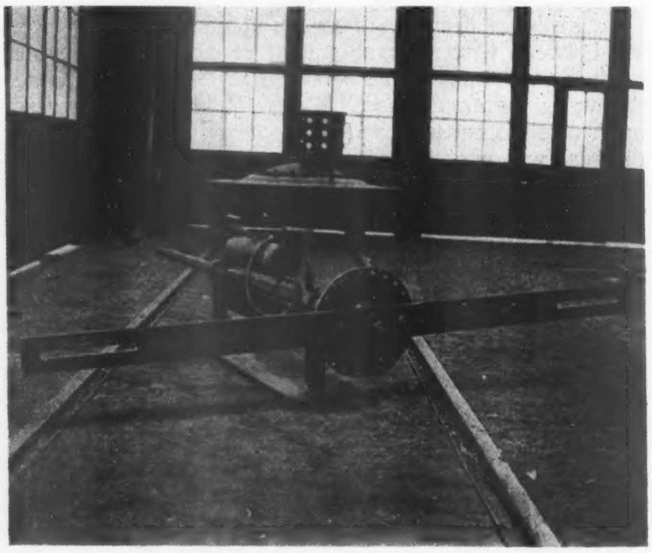
Special gage for checking driving-box saddle seats

This gage consists of two steel plates, one of which extends over the top of the box through the saddle and shows the exact center line of the shoe-and-wedge faces. The other plate fits in the shoe-and-wedge face of the box, being automatically centered by two short pieces of angle steel capable of parallel extension against the sides of the shoe-and-wedge ways. The construction of this gage is quite clearly shown in the illustration.

In using this gage, the saddle is placed on the driving box and the gage is applied between the flanges and against one of the shoe-and-wedge faces. The parallel angles are then pressed out until they contact the flanges. The saddle clearance can at once be noted by measuring from the center line. Squareness of the saddle seats on the box is checked by using a combination square from the top plate to the saddle seat.

Drilling Holes in New Cylinder Saddles

The process of changing from cast-iron to cast-steel cylinders on certain classes of Santa Fe power developed the need for a more efficient method of drilling



An unusually convenient cylinder-saddle drill jig

cylinder saddle-bolt holes, formerly done by using a portable pneumatic drill and an "Old-Man" which had to be changed in position for each hole. The device illustrated has been developed to give proper radial alignment to the motor and permit the drilling of all holes with one set-up.

The drill jib is T-shaped and consists of a hexagon bar with indexed crosspiece of flat steel. The crosspiece is bolted to the front-end door ring, on the smoke box center line and the end of the hexagon bar is placed in the center flue. A sliding saddle moves on the bar, the lower section of cylindrical plate serving as a stop for the air-motor feed screw. On top of the saddle is placed a small sheet metal cylinder to contain the cutting compound which is allowed to flow by gravity through a small hose line to the point of drill. The circular plate at the junction of the bar and the crosspiece is indexed, as shown, to permit locking the bar in place when drilling holes at an angle. This drill jig, which is set up and operated by one man, is said to reduce the time of drilling cylinder saddle-bolt holes 50 per cent.

Device for Removing Superheater Units

With the application of Type E superheater units, difficulty is sometimes experienced in removing these units when repairs are necessary to the units, flues or flue sheets, since each of the four loops of each unit is in a separate flue and there is a tendency to jam or bind when the units are being removed. To meet this condition, the superheater unit puller, was developed.

The device comprises a ladder-type scaffold and platform, carried on four flanged wheels and having a power unit in the base which consists of a track-wrench motor of a type now obsolete for its original purpose. This motor operates from the shop air line and drives a Foote reduction gear with a ratio of 11½ to 1. A shaft, mounted on the base of the scaffold back of the motor and not shown in the illustration, carries two drums for winding up the rope used in pulling units. The single sliding pulley and shaft at the top of the scaffold are capable of vertical adjustment as required to give a direct pull on the units. A platform provides firm footing, at the proper elevation, for men engaged in removing the units. A unit-carrying platform, mounted on wheels, is placed between the puller and the locomotive front end.

The superheater unit puller, set in place ready for operation

In operation, the unit puller is blocked the proper distance away from the locomotive front end and a chain placed on three units at once, the puller rope being given a turn or two around the large drum and the air motor started. In most cases this pulls the three units immediately. However, if any difficulty is experienced, the rope is applied around the smaller drum, which decreases the speed and greatly increases the pulling power. The use of this device has reduced the time of unit removal about 75 per cent. Two men only are required, one operating the motor and the rope connection and the other hooking on units and properly positioning them on the unit-carrying platform.

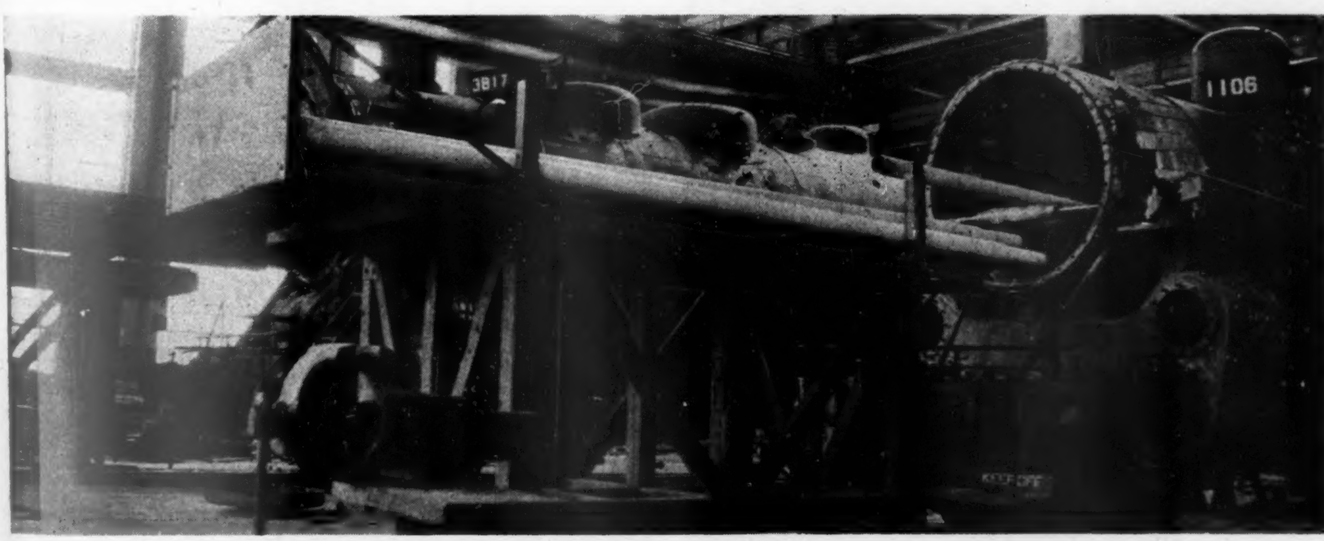
Quick Removal of Flues from Boilers

Recent substantially increased flue work at Albuquerque shop has been greatly expedited, at least insofar as handling flues is concerned, by means of the ball-bearing roller shown in one of the illustrations. This device consists of a cylinder made of steel tubing which operates on ball bearings around a shaft of smaller size. Provision is made for shortening or lengthening the bars to fit smokeboxes of different size by means of a telescoping tube construction, with small pins used to hold the telescope sections wherever they may be set. The ball bearings used are old bearings removed from centrifugal feed-water pumps.

The general idea of this device is to provide a free running support for boiler tubes and flues as they are being removed from locomotive front ends. Three men were formerly required for this work, but the use of the ball-bearing roller permits the tubes and flues to readily slide out against the sheet-metal stop on the flue rack and save the work of at least one man.

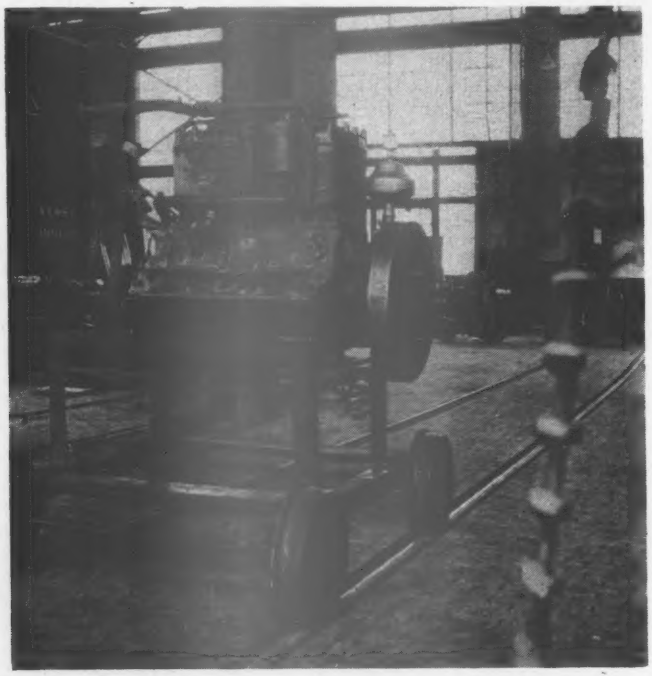
Portable Rack for Repairing Gasoline Engines

To facilitate repairs on large gasoline engines for work equipment, a portable rack has been developed, as



Ball bearing cylinder which facilitates removing tubes and flues from locomotive front end

illustrated. This consists of two pairs of old push-car wheels carrying a welded frame built up of steel bars and angles and arranged to support the engine at a suitable height for most convenient work. The upper parts of the engine can be readily reached by standing on the lower bars of the frame, and ample room is



Portable gasoline engine repair and test rack

provided to get under the engine for necessary inspection and repairs.

This portable rack provides a convenient means of moving the engine on standard-gage rails between the various shop departments, and it also serves as a test

Special swedging device used in finishing welded tender brake-beam ends without subsequent machining

rack to support the engine during preliminary break-in operation. The rack, which is easily made, has demonstrated its value in the reduced time of handling work-equipment gasoline engines during necessary repair and testing operations.

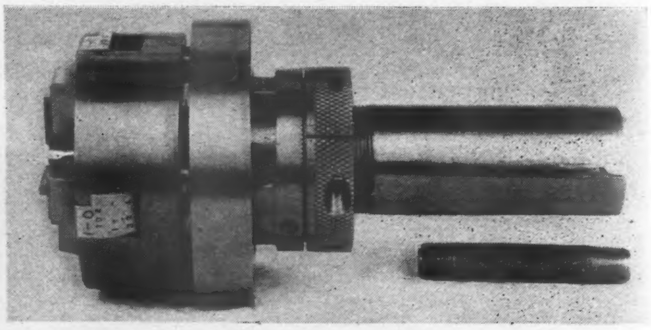
Building up Worn Tender Brake-Beam Ends

To eliminate the necessity of turning tender brake-beam ends, after being built up by autogenous welding, the device illustrated has been developed and is now giving satisfactory service at Albuquerque shops. It consists of a long rack equipped with an adjustable sliding block to support one end of the brake beam and dies at the other end, operated by an old flue swedger. After the building-up operation is completed and while the brake beam end is still hot, it is placed in the die and swedged down to a smooth finish of proper size to fit the hole in the brake-shoe head without further machining or finishing. The machine set-up time and the time and cost of the machinery operation, itself, are thus saved.

Taper Chaser Die Heads

AN IMPROVED line of chaser die heads has been developed by the Eastern Machine Screw Corporation, New Haven, Conn., for cutting taper pipe threads. The die head is designed to cause the chasers to recede at a definite rate until, when the proper length of thread is cut, the die head instantly opens, withdrawing the chasers from the work. The actual taper is governed by the action of the die head instead of being dependent on the chasers themselves and thus pipe threads with proper taper are assured.

The chasers do their cutting at the chamfer only, leaving no visible marks. Taper action is obtained by means of a rotating opening cam placed between the back plate of the head and the knurled adjusting nut on the shank. The angular position of this cam is determined by a work plunger inside of the die head shank, which, when pushed back by the work, rotates the opening cam at a pre-determined rate. This rotating cam



H. & G. taper cutting inserted chaser die head, style TM

is adjustable for position and together with adjustment of the work plunger, determines the length of taper thread. The amount of taper is fixed by the incline on this opening cam and the final opening of the die head is accomplished by a sudden drop in the cam. A fine adjustment for pitch diameter is obtained by the knurled adjustment nut.

These die heads may also be equipped with a chamfering and reaming tool that will chamfer and ream the end of pipe nipples at the same time that the thread is being cut.

Jim dressed slowly, still about half asleep

FROM SEVEN TO SEVEN

***by* Walt Wyre**

JIM EVANS was snoring like an oversensitive boiler pop and almost as loud, when the alarm clock on a stand by his bedside rattled insistently. Jim stirred uneasily, reached over and shut off the alarm without waking, and murmured, "That blamed switch engine bell is cracked," and was almost instantly snoring again.

He didn't snore long; his wife poked him in the ribs. "What are you grumbling about?"

"Huh—huh—" Jim grunted.

"Wake up, five-thirty," Mrs. Evans reminded him.

He yawned prodigiously, and with an effort opened one eye. He was thinking about trying to open the other when his wife gave him another dig in the ribs, and the eye opened involuntarily.

"Get up!" Mrs. Evans insisted.

"Dadblast it! I was dreaming—dreamed that roundhouse foremen didn't have to work but eight hours a day and had every other Sunday off when that blamed switch engine came by and—"

"Well, being as it was a dream and you are supposed to be at work by seven o'clock, you'd better drag out!"

Jim drug out. After a little fumbling, he found the light switch and turned on the light. His wife followed close behind, wriggled into a heavy bath-robe, fur trimmed house slippers, and shuffled towards the kitchen. Jim dressed slowly, still about half asleep, and was splashing his face with cold water to wake it up when the sound of toast being scraped reminded him breakfast was just about ready.

He finished breakfast, smoked a cigarette with his second cup of coffee, and was ready to go. When he opened the door, a blast of icy air struck his face; frost crystals sparkled in the beam of a flashlight he played on the ground before him as he walked to the garage.

The starter on the car did its best when Jim pressed the switch, but its best wasn't enough. Congealed oil held bearings and glued pistons to cylinder walls with a tenacity that the starter couldn't overcome. He found the crank and bent the handle turning the cold motor. A couple of "p-futs" rewarded ten minutes of effort and profanity.

"Want me to help you?" Mrs. Evans called from the doorway.

"Hell, no! I'll walk," Jim replied, and started on the mile walk to the roundhouse.

A tinge of red was showing in the east when Jim reached the roundhouse. It wasn't yet light enough to see well, but he didn't need light. Eight of his twenty-odd years with the S. P. & W. had been spent as roundhouse foreman at Plainville.

THE seven o'clock whistle blew just as Evans reached the roundhouse office. Bob Parker, the night fore-

man, muffled to the ears in sheep skin coat and fur cap was waiting to go home.

"How's things going?" Jim greeted.

"Oh, about so-so," Parker replied. "Pretty cold; had trouble with the fuel oil, so cold the pump wouldn't handle it. Dynamo froze and bursted on the 5088. S'all in the dope book," Parker told him. "But it's not near as cold as I have seen it. Why, I remember one time when I was on the Big Four—"

"Anything called?" Jim interrupted.

"5092 for No. 11. The passenger is three hours late; be in about eight-ten; engine's outside," the night foreman replied as he opened the door to leave.

Evans took a chew of "horseshoe" and sat down at his desk to look over the dope book and the morning line-up. On account of the cold and high winds, trains were running late in spite of reduced tonnage and extra sections when necessary. The way the line-up showed it, there would be one extra engine over the number required, counting the 5076 that would come in No. 11.

"Well, that's not so bad," he mused as he gathered up work reports and slips. "Hope the 5076 don't have too much on her."

The phone rang before Jim finished sorting the work slips. The night clerk went off at six A. M. and the day clerk didn't come on until eight. Jim answered the phone. It was the dispatcher wanting to know what engine for the Gold Ball east bound freight No. 82. Jim told him and went back to sorting work slips. Starkey, the general foreman, came in just about time Evans was through.

After exchanging greetings with the general foreman, Jim went to the roundhouse. He distributed the work slips in pigeon holes for the various mechanics. Almost subconsciously he gave each man of a craft the particular class of work the man could do best. The slips were distributed and work reports placed in holders in front of the engines to be worked by the time the eight o'clock whistle notified the day force it was time to go to work. It took about fifteen minutes to get the bunch lined out.

Jim was circling the turntable pit on the way back to the office when he met the engineer that was to go out on No. 11. "Branch pipe froze solid," the hog-head told him.

Evans swore fervently, mentioning the ancestry of hostlers in general, and the one on the third trick in particular that had allowed the branch pipe to freeze. He took a fresh chew and went back to the roundhouse to look for a pipe man.

While he was looking for the pipe man, Machinist Johnson stopped Evans. "We've got the dome cover off the 2874; wish you'd take a look at the throttle valve."

"Be back in a minute," the foreman said without stopping.

There was a thirty-minute delay on No. 11 thawing the frozen pipe. After it was thawed, Jim went by the 2874 to look at the throttle.

"Say, Mr. Evans, we need some blacksmith coal," the blacksmith told the foreman as he came down off the 2874. "And some one on nights used the fire last night—heated brass or something—anyway, I had to clean it all out before I could make a weld," he complained.

"O. K., I'll tell the storekeeper to order some coal and leave a note to Parker about night men using the forge. They have orders to use the gas furnace for heating," Evans added.

IT took Jim fifteen minutes to get to the roundhouse. He was stopped four times on the way. He had just sat down at the desk, feet propped on an open drawer for a moment's relaxation, when the inspector came in.

"There's a bad crack in the left cylinder casting of the 5076; she came in on No. 11." The inspector beamed, as though finding a cracked cylinder on the only extra engine that was available for service at the time was something to be proud of.

Evans' feet dropped to the floor with a thump. The inspector followed him out to the 5076. The casting was cracked. No doubt about it, right up next to the flange where the two cylinder castings bolted together. A thin white line showed where steam had been leaking.

"Well, we can't run it that way, that's a damned cinch!" Jim remarked reflectively. "Maybe we won't need her," he added hopefully.

He went back to the office to break the news to the general foreman.

"How long will it take to get the 5082 off the drop-pit?" Starkey asked.

"Oh, hell—two days at best without working overtime on it, and I'd rather pay it myself than listen to the master mechanic rave about overtime."

"Yeah," Starkey said, "but they're standing on his tail about it too. Maybe we can make out somehow."

The phone interrupted the conversation. "Roundhouse clerk talking." John Harris picked up a pencil as he answered the phone. He made notes on a pad of yellow clip as he listened. "O. K., I'll tell him." Harris hung the receiver on the hook. . . . "Dispatcher wants an extra east at eight o'clock—trainload of movie people from Los Angeles—said to be sure and have a 5000 in good shape. Conover is riding the train," Harris added. Conover was the superintendent of motive power.

"Now ain't that nice?" Evans' voice dripped sarcasm. "Where'm I supposed to get any 5000 engine, let alone a good one—pull it out of my hat like a magician does rabbits?"

"Maybe," said Starkey, "the cylinder on the 5076 is not cracked bad as you think."

"It might not be, but I don't want to take the chance. When one of them castings starts cracking, they go fast. If I'd run that engine, the right cylinder would fall off, sure as hell. That happened three years ago on the 5079. The stink raised about it would have made a skunk think he needed a gland operation."

Nevertheless, it was the 5076 or a freight engine, and Evans went out to look it over again. Starkey went with him.

The hostler had the engine on the turntable when the two foremen got there. They waited until the engine was run in the house. Eight above zero was pretty cold to stand around in, anyway.

When the engine was in the house, Starkey told the hostler to apply the brakes and open the throttle a little. When he did, steam hissed through the crack in the cylinder.

"Nope," Starkey shook his head disconsolately, "can't run that way. I'll go see how the boys are getting along on the drop-pit."

Evans stayed at the 5076. He added a hunk of "horseshoe" big as a hen egg to the cud in his jaw and spat reflectively. One eye closed like he was aiming a gun; he stooped and sighted across the front and back of the cylinders. "That might do it," he spoke aloud to himself, as he started to the storeroom.

Jim was pleasantly surprised to find the things he wanted in the storeroom, two draw bars for 1600 class engines and four three-inch hex nuts and some three-inch round cold rolled steel. He hurried back to the roundhouse and put a machinist and helper at work on the job.

The general foreman came up while Evans was giving

instructions to the machinist. "Looks like a 2800 or nothing." Starkey's voice sounded like he was telling of a recent bereavement.

"Maybe not." Jim's teeth met in a plug of "horseshoe." "I'm going to take a shot at fixing it." He indicated the 5076 with the stub ended thumb of his left hand.

The clerk interrupted further conversation. "The brains wants to know what about an engine for the special, said tell you to be sure and have a good 5000, they're going to be late; hit a snowstorm west of here, want to make the time up."

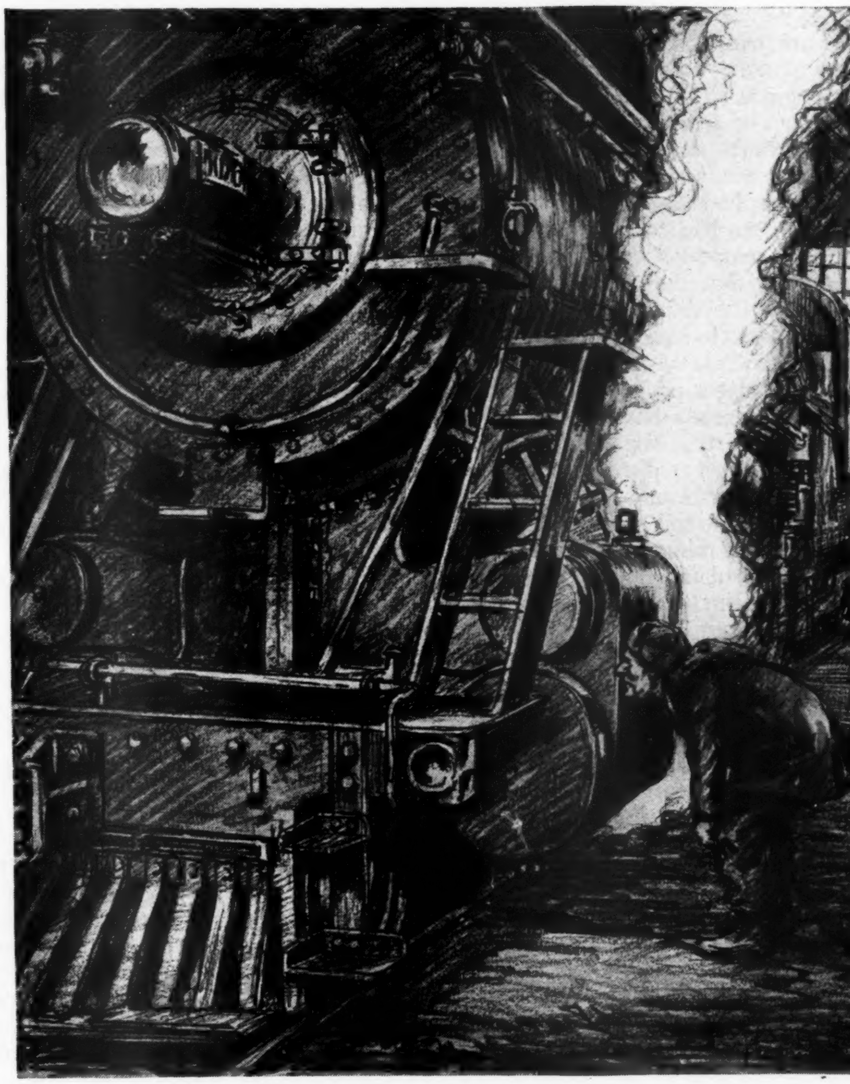
"Tell him the 5076 and tell him if he'll get 'em over the road, we'll get 'em out of the house," Evans snapped.

Harris opened his mouth to say something, changed his mind and went back to the office.

"Dynamo on the 2819 needs a new steam head—froze and bursted." It was Ned Sparks, the electrician. "Not any in the storeroom," he added.

"Get one off the 5082. She's on the drop-pit. Tell the storekeeper to wire for one."

Sparks understood the foreman meant to wire for a dynamo steam head and not for a drop-pit.



One eye closed like he was aiming a gun, he stooped and sighted across the front of the cylinders

THE twelve o'clock whistle blew before Jim realized that the morning was half gone. He rode home to lunch in the car with Starkey. At one o'clock he went to the roundhouse to see how the machinist was getting along on the 5076. The work was progressing nicely. Two other machinists were put to work going over other parts of the locomotive to see that everything was in first-class shape. He had the lubricator set to supply more oil to the cylinders and even told the supply boy to put on an extra quart of engine oil.

"Probably get a letter from the president of the road if he hears about the extra valve oil," Jim remarked, "but I want to be certain she's lubricating."

Evans stayed with the machinist on the job of repairing the 5076 most of the afternoon; that is, he was with him except when answering the phone, showing how various other jobs should be done, O.K.ing requisitions for tools, doing a little engine spotting when the hostler was busy getting engines out, checking work reports, and handing out work slips, and a few other odd jobs that don't count in a roundhouse foreman's twelve-hour tour of duty.

The job on the 5076 was finished shortly before five o'clock. Jacket was removed from cylinders and valves, leaving the castings exposed. The two drawbars were placed lengthwise of the cylinders, one on each side in the depression that marks the junction of the valve chamber and cylinder. A little chipping was necessary for the rectangular bar to fit snugly against the casting. Two three-inch rods of cold rolled steel, threaded on each end, held the drawbars in place, forming in effect a large clamp around the two cylinder castings. The rods were through the holes in each end of the two drawbars. Holes in the drawbars were too large for the three-inch rods, so washers were cut from one-inch boiler plate and slipped over the rods between drawbar and nuts.

Getting the rods in place presented quite a problem. Space was narrow and the opening obstructed so that the rods had to be kinked in several places to go through. A template of half-inch rod was used to get the exact shape of the bends; quarter-inch was tried, but wouldn't hold its shape.

Before the nuts on the rods were drawn up tight, Evans had the machinist drill a small hole at each end of the crack in the casting. This was done to prevent the crack progressing. Round iron plugs were driven in the holes. Nuts on the rods were drawn tight, allowed to stand awhile, and tightened again to take out the stretch.

"Well, it looks like a threshing machine, but I believe it'll hold together," Evans told the general foreman when the job was finished.

Evans just had time before five o'clock to go through the house and see if work was finished on locomotives needed for night trains. It wasn't—there was more work than the handful of men on nights could possibly get done. The unlooked-for job on the 5076 was partly at fault. Two machinists and their helpers were told

to work overtime. That meant more explaining, Evans knew, but no way out of it. The work had to be done if the engines were to run.

After the five o'clock whistle blew, Jim gathered up work reports and slips on jobs to be left for the night men and went to the roundhouse office. Some of the mechanics had neglected to sign work reports for jobs done and he had to go back to the roundhouse to check up. He swore he was going to take the next man out of service that did a job and failed to sign for it, and knew that he didn't mean it.

By six o'clock, things seemed to be in pretty good shape. Evans was taking a well earned rest, feet on desk and pipe burning evenly, when the hostler came in.

"Say, there's a bad air leak on the 2842; she's called for seven-thirty," the hostler said.

Evans swore apathetically and went back to the roundhouse. He told one of the machinists that was working overtime to get some tools and come out to the 2842. After twenty minutes' search, the leak was located. The pipe-fitter had failed to tighten a union on the air reservoir pipe. Jim got his feet thawed out by seven o'clock and time to go home.

Two days later, there was a letter from the superintendent of motive power. The letter said in part: "Performance of engine 5076 on the special was satisfactory. Appearance of the engine was disreputable. Please explain why an engine in such a condition was used on this important train. I want to impress the fact that good appearance of all our engines is important and particularly of passenger equipment. If necessary to use repairs that disfigure our engines, in the future use them only on engines in freight service."

"Well, I'd rather answer that than explain why the train didn't have any engine at all," Jim commented as he took a fresh chew and started out on another twelve-hour day.

Repairing Pneumatic Drills At Pitcairn Shops*

MANY types of pneumatic drills are required at the Pennsylvania Pitcairn (Pa.) air-brake repair shop which handles the work for the Central Region of that system. These will vary from a small ¼-in. maximum capacity drill to the heavy duty close-quarter types which will handle 3-in. drills.

Disassembly of Pneumatic Drills

Upon being received at the shop the pneumatic drills are tested in order to determine what their condition may be and the extent to which they can be operated. They are then dismantled and the parts are thoroughly cleaned in a tank containing a turpentine substitute. In dismantling the protectors are removed from the spindle. The crank caps are removed, then the chamber plates, cylinder heads and exhaust deflectors. On the long-stroke, four-cylinder drills the crank assembly is removed as a unit. In order to do this the rotary valve is removed to release the vacuum behind the pistons. The crank is then turned until one piston is on dead center at the top of the stroke. Then the whole crank is raised and pulled in a direction away from the piston. When the piston slips out of the cylinder further upward movement of the crank is stopped and the crank is moved sideways to remove the opposite piston from the same crank pin. The other pair of pistons is removed in the same manner. To disassemble the crank on this type of drill the taper pins which aline the crank pins and the crank web are driven out and the web pinch bolt is removed. The pinch bolt is screwed in again from the reverse side of the web against the web spreading plate, or a hardened steel plate is inserted in the slot, after which the upper and lower crank ends are removed.

There is another type of four-cylinder drill in which the crank assembly is removed as follows: A pair of

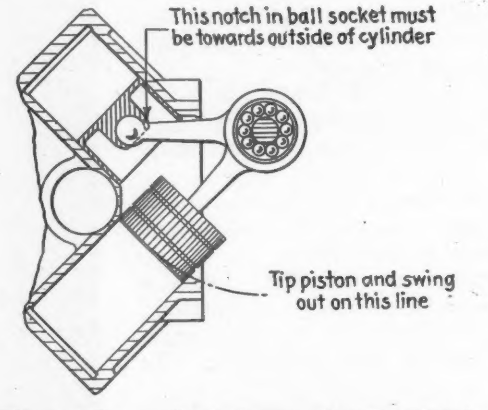


Fig. 1—The method of removing the pistons from the cylinders

long-nose pliers is inserted into the piston and the ends of the pliers inserted in two small holes in the connecting rod springs. The spring ends are then squeezed together and pulled from the piston. After all four springs are loose the crank may be lifted from its place. On still another type of drill the rotary valve is first removed and the pistons are turned in their cylinders until the notch in the ball socket is toward the outside of the cylinder. The crank pin nearest to the pinion is turned to its highest position. The whole crank is lifted upward and, as the pistons attached to this pin are raised in their cylinder, the crank and connecting rod are rocked to one side of the case until one rod enters the notch in the ball socket. The movement is continued until the rod touches both the rim of the piston and the edge of the cylinder. The opposite piston is then removed by tipping and swinging it out of the case as shown in Fig. 1. The first piston is removed by turning the crank pin to the opposite side of the case and pulling it straight out. The remaining pistons are removed in the same manner.

There is still another type of drill which has pistons with cut-away sides. These are removed by turning the crank until one of the crank throws is in the highest position. Then the pistons connected to this throw are turned so that their cut-away sides are toward each other. These two pistons can now be lifted out by pulling on the crank. The remaining two pistons can then be removed in a similar manner. After the crank shaft has been removed from the casing, the top ball race is removed, the crank screw taken out and the crank rollers removed through the screw hole one by one. It is then an easy manner to slip each pair of connecting rods with their bushings over the end of the crank shaft. Certain precautions should be observed when repairing this type of drill. Each crank screw must be put back in the same hole from which it was removed, as they are not interchangeable after having been fitted to any one hole. One type of crank assembly can be taken apart by removing the connecting-rod screw which permits one half of the hinged bearing to open up, allowing the connecting rod to enter the crank.

* This is the seventh of a series of articles dealing with repair work at the Pitcairn air-brake shop.

One type of lever-driven close-quarter drill is disassembled as follows: The gear cover is removed from the top of the cylinder and the bearing cap and bearing spring washer from the bottom of the cylinder. Then all of the case cap screws are removed. The cylinder will come apart and expose the entire operating mechanism. If it is desired to remove the levers, the thrust bearing end is unscrewed and the thrust bearing and its race are removed. The spindle is then pushed out of the cylinder. If a spindle ring is pressed on the lower end of the spindle, then the spindle is driven out with a soft hammer. The levers with pistons attached and with the crank complete may be lifted out. To remove the levers from the crank the bearing nut is unscrewed and the bearing pulled from the lower end of the crank. To remove crank rollers and bushings a pointed tool is used to lift out the spring which holds each split bushing in place. Then the bushing can be removed from the rollers, one at a time, and the rollers removed from the ends of the crank.

Repair Practice on Pneumatic Tools

In repairing pneumatic drills, valve bushings, when worn, are reamed to an oversize sufficient to true them up and oversize valves are lapped in. When valve bushings are cracked or worn or reamed to a size which does not justify further reaming in the judgment of the repair man, they are scrapped. The reverse-valve bushing on reversible type drills is renewable. The worn bushing is removed by inserting a chisel at one side and curling the bushing in; then it may be pulled out. Another method is to tap a thread in the bushing and remove it by inserting a bolt. A new bushing is located radially by its key and pressed in flush with the cylinder case. The bushing is reamed to size after being pressed in place and the reverse valve lapped in. The rotary valve bushing is removed from the upper or feed-screw end and pressed in flush with the bottom of the governor chamber. After being pressed into place it is reamed to take the rotary valve.

The cylinders on some types of drills are ground sufficiently to true them up and oversize pistons are used, the pistons being lapped into the cylinders, while on other types the cylinder bushings are renewed and standard pistons are applied. Pistons are scrapped when they are worn .003 in. below standard cylinder diameter, or if the connecting-rod socket, connecting rod or the rod connections on the piston are broken. When the inside or outside toggle or crank are worn to the extent of .005 in. or if the same amount of wear exists on the inside and outside connecting rod and crank, the necessary parts are renewed to take up the wear. When the connecting-rod socket is worn .003 in., it is scrapped.

When it is necessary to renew any rollers on a crank pin, it is desirable to apply an entire new set to that pin in order to assure uniform diameter of rollers. When it is found necessary to renew a crank screw, the crank is disassembled and a new screw put in place, seating the screw until the locking wire hole or slot is flush with the crank, after which the locking wire is inserted and fastened. The end of the screw is then filed flush with the surface at the crank pin end in order to have the rollers pass without interference. After the rollers have been put in place the repairman should make sure that the crank screw has been turned in the proper distance so that the roller ends will have a flush face to work against. A locking wire is inserted and fastened and care must be taken to see that the position of the screw is not disturbed when adjusting the locking wire.

On certain types of drills, when assembling a crank pinion on a crank, the tooth of the pinion is stamped *0*. This mark is lined up with an arrow stamped on the crank throw just outside the bearing. It is important to see that this is done, as the timing would be affected if the pinion were inserted in the opposite manner.

When assembling the crank on long-stroke, four-cylinder drills the web is spread by means of the pinch bolt referred to in the description of the disassembling operation. This permits the crank pins to slip into place. The crank-pin sleeves, connecting-rod bushings and the connecting rods are then put into place. The upper crank pin has an *X* stamped on the end and there is also an *X* stamped on the center web close to one of the crank-pin holes. The pin is placed in the center web first, from the finished side of the hole so that the *X* marks are adjacent. The lower crank pin is then put into its proper place. The crank-pin sleeves are renewable and are provided with an extension lug which fits into the slot in the web and prevents turning with respect to the crank pin. The crank is then alined by replacing the taper pins which are tapped lightly into place with a hammer. The old taper pins are generally scrapped, as new ones insure perfect alinement. The crank web pinch bolt is then removed and replaced from the opposite side of the web and tightened firmly with its lock nut turned down and fastened by a cotter pin, while the bolt head is held in a vise or by a wrench. The taper pins are then driven firmly into place and the split ends spread. It is important that the pinch bolt be firmly tightened and held while the lock nut is turned in order to prevent the bolt from being loosened, which will place the driving strain on the taper pins. The two crank ends are stamped with the same designating symbol and are assembled together. Care is taken to see that parts of two different cranks are not assembled, as they are not interchangeable. On the majority of the four-cylinder, long-stroke drills the crank is assembled complete before being placed in the drill. On one particular type of drill the one piston is inserted in its cylinder and the crank moved sidewise in order to insert the other piston on the same crank pin. The other two pistons are applied in the same manner.

With respect to the type equipped with connecting-rod springs, all four of the pistons are placed in their cylinders. The crank is put in place with connecting rods and the springs assembled. One spring is inserted at a time, the piston being pushed to the bottom of the cylinder. The crank is rotated until the ball on the connecting rod reaches its seat in the piston. The spring is then pushed down into position by means of a forked tool, a light tap with a hammer assisting in pushing the spring into place. Another type of drill in which there is a notch in the ball socket of each connecting rod is assembled as follows: One piston is placed in the cylinder with the notch toward the outside of the cylinder and the rod entering the notch. At the point where the rod touches both the edge of the cylinder and the rim of the piston the opposite piston is inserted in the cylinder, the notch in the ball socket being turned to the outside of the cylinder. The remaining pair of pistons is applied to the cylinder in the same manner.

When assembling the type of drill having cut-away pistons the pistons are turned so that the cut-away sides are toward each other. With one crank throw in its highest position the two pistons on each throw can be inserted at the same time. A governor is applied to a great many drills for the purpose of preventing excessive speeds when the drill is operated with a very light load or no load at all. This governor is screwed onto the end of the rotary rod and is seldom removed. In case it must be removed, care is taken to see that when it is replaced it is locked in the valve again. On some types

of drills this is done by peening the lower end of the thread on the governor. This can be done by working through the two exhaust ports near the end of the valve. On another type of drill the locking is accomplished by center punching the flange on the governor body in the two milled slots on the end of the rotary valve. To remove the governor from the valve a wrench made to fit the hexagon hole in the governor is used. Only the specified springs for each type of governor are used.

On certain types of drills the rotary-valve pinion is too large in diameter to pass through the bushing and is made separate from the valve. The pinion is removed in preference to the governor when it is desired to remove the valve from the drill.

Gears are renewed when broken or badly worn. Radial thrust bearings which take the spindle thrust are assembled with the side of the outer race stamped for thrust down or toward the spindle. The bearing is always assembled with a movable race toward the spindle.

On the lever-driven, close-quarter drills the assembly is accomplished as follows. It is necessary to hold back the ratchet pawls with a screw driver or similar tool while passing the spindle through the levers. This is most easily accomplished by starting the spindle through

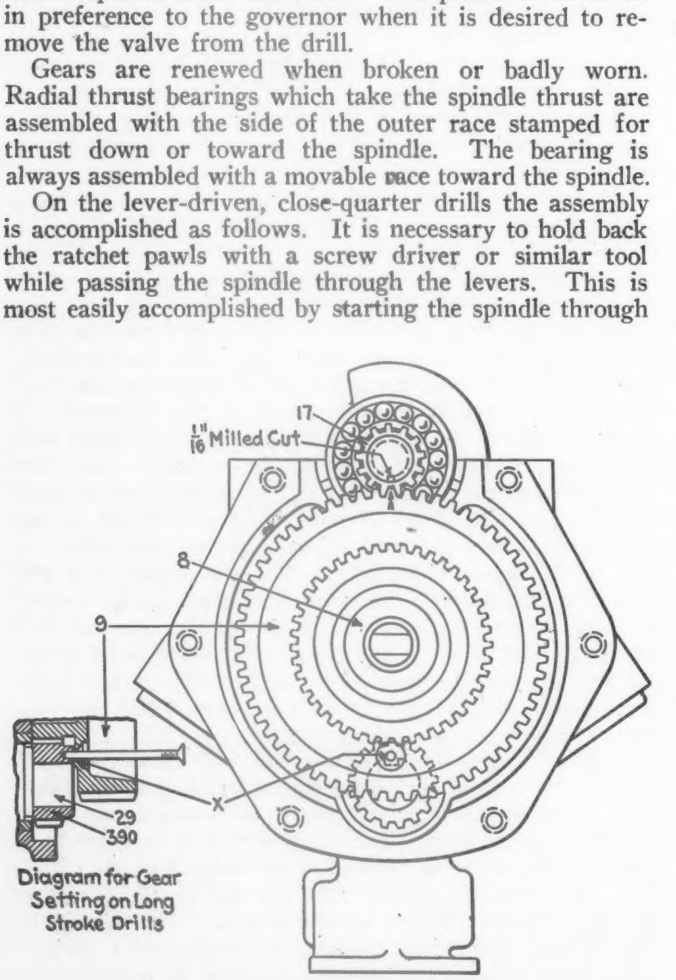


Fig. 2—Valve timing and gear setting

the cylinder until it strikes the first pawl and then turning the entire drill up and resting the piston end of the cylinder on the bench so that the whole weight of the cylinder and lever falls on the first pawl. Each pawl is then released with a convenient tool, permitting the lever to drop down over the spindle. The pistons are inserted in the cylinder bores, one at a time, beginning with either outside piston. The repairman should make sure that the lower bearing ring is in position before replacing the bearing cap.

Valve Timing and Gear Setting

Fig. 2 shows a diagram for gear setting on one type of long-stroke drill. The spindle gear (part No. 9) is inserted so that the arrow stamped on one of the teeth engages the tooth space on the crank pinion (part No. 17) marked by a 1/16-in. milled cut. A wire or nail is inserted in the hole in the spindle gear web marked *X* on the drawing and the rotary valve is turned until the wire engages the hole in the top of the valve (part No. 29) then the teeth are meshed. In order to assemble the gears on this type of drill it is necessary to set the intermediate gears properly. This is done when the gear frame with the three intermediate gears assembled is placed in the gear case. The *X* stamped on each intermediate gear is lined up with the marks which are stamped 120 deg. apart on the spindle gear.

Fig. 3 illustrates the method of setting the valves on an older type of drill. In this case it is only necessary to see that the letters stamped on the crank pinion and the valves register with those stamped on the spindle gear. The two rotary valves are interchangeable.

The valve timing and the assembling of the gear on

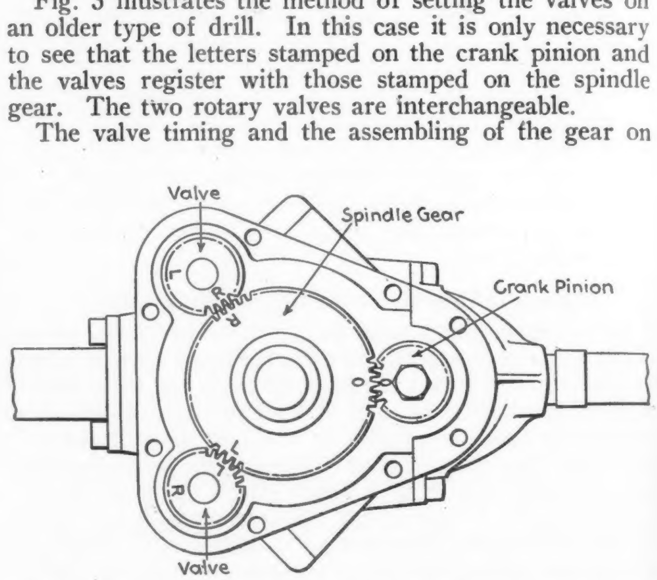


Fig. 3—The manner in which the valves are timed on this type of drill

gear-driven, close-quarter drills is accomplished as follows. The rotary valve is inserted in its bushing in the assembled cylinder and the valve shaft is placed in the valve. The valve-shaft pin will fit into the valve in two positions, either one being correct. Next the crank is rotated until a small drilled hole in the upper crank web comes directly under the milled notch in the case cover flange on the case. The end of one gear tooth on the valve shaft has the end beveled off. With the crank in the above-described position the cylinder is placed in

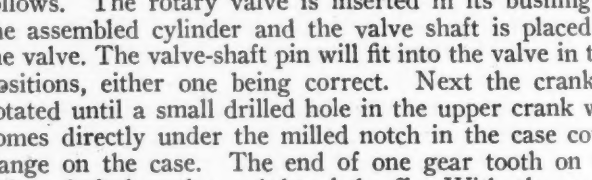


Fig. 4—How the gears are lined up on a lever-driven close-quarter drill

the case and, while this is being done, the valve-shaft gear is meshed with the gear on the center web of the crank so that the bevel on the tooth comes directly under another milled notch in the flange on the case cover.

To assemble the gears the spindle is placed with its bearing on it in the case. The lower drive shaft is then assembled in the case by inserting the bottom plate first and then the roller-bearing race. Next the rollers are set in with grease and finally the top plate is put in position. The drive-shaft pinion gear spacer and drive-

shaft gear are then placed in position in the machine and the drive shaft with the upper bearing assembly on it is pushed through them until the lower end enters the lower bearing. Next, the intermediate shaft, with its bearing, bearing spacer and gear assembled on it, is inserted in the drill from the lower side. The crank is then assembled with its bearing and pinion and dropped into position from the top.

To time the valves on lever-driven, close-quarter drills it is necessary to line up the gears as shown in Fig. 4. The stamped teeth on the intermediate gear (No. 10) engage the tooth spaces on the crank pinion (No. 17) and the rotary valve (No. 29).

New bodies are not used in making repairs as the cost does not justify the practice. Parts of old drills retained after the bodies are scrapped are used in making repairs to other drills of the same type when they are suitable. Pneumatic drill bodies are scrapped when

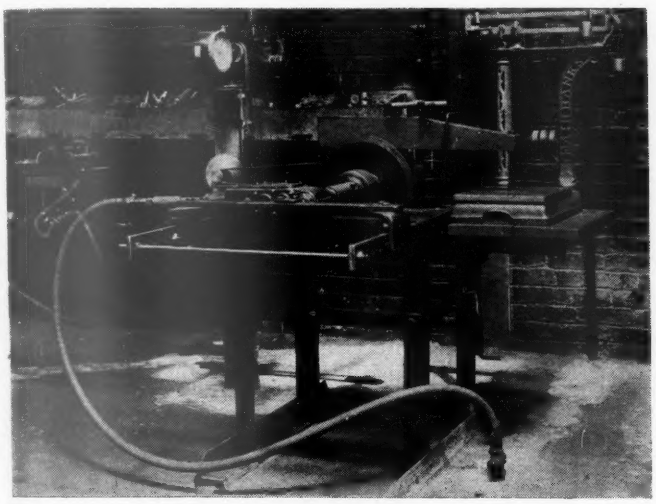


Fig. 5—Test device for determining the efficiency of repaired pneumatic drills

cracked or when they are so badly dented that the dents cannot be removed sufficiently to permit proper repairs to the drill. Housings are reclaimed by re-cutting threads and using oversize packing nuts when threads are damaged. While pneumatic drills are being removed, they are lubricated with a special air-motor grease.

Testing Pneumatic Tools

After the drills have been repaired they are subjected to a test to determine whether or not they are capable of performance equal to the manufacturer's rating. The device used for testing drills is shown in Fig. 5. This device is equipped with a tachometer to indicate the speed of the drill spindle, as well as a Tool-om-eter for indicating the consumption of air in cubic feet per minute. The brake horsepower of the drill under test is calculated by the formula

$$\text{Hp.} = \frac{2\,\pi \times r \times l \times \text{r.p.m.}}{33{,}000}$$

in which

r = the length of the brake arm in feet (1.575 ft.)
l = the weight required to balance the downward pressure of the brake arm
r.p.m. = revolutions per minute as shown by the tachometer

The following table gives the results of a test on a four-cylinder drill which will illustrate the method of calculating the horsepower. The free running speed of the drill is 410 r.p.m., with an air consumption of 66 cu. ft. per min. As the load on the brake arm was increased the following values were indicated:

Weight, lb.	R.p.m.	Ft. lb.
20	260	5,200
25	225	5,625
30	190	5,700
35	170	5,950
40	150	6,000
45	130	5,850

It will be noted from the above table that the best performance was indicated at a weight on the brake arm of 40 lb. Calculating the horsepower by the above formula, the result is 1.80, which compares favorably with the manufacturer's rating of 1.84 for this type of drill. Any pneumatic drills which fail to compare favorably with the manufacturer's power rating are re-examined to determine the cause of their poor performance.

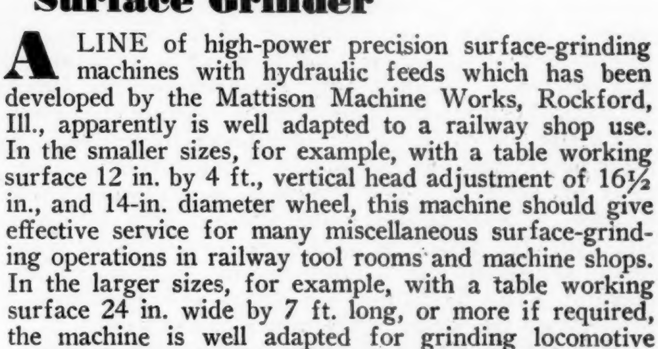
When the drills have passed the tests satisfactorily, they are packed for shipment and the necessary records are entered as to type, date of repairs, etc. Approximately 80 pneumatic drills are repaired at the Pitcairn shop each month.

High-Power Precision Surface Grinder

A LINE of high-power precision surface-grinding machines with hydraulic feeds which has been developed by the Mattison Machine Works, Rockford, Ill., apparently is well adapted to a railway shop use. In the smaller sizes, for example, with a table working surface 12 in. by 4 ft., vertical head adjustment of 16½ in., and 14-in. diameter wheel, this machine should give effective service for many miscellaneous surface-grinding operations in railway tool rooms and machine shops. In the larger sizes, for example, with a table working surface 24 in. wide by 7 ft. long, or more if required, the machine is well adapted for grinding locomotive rod sections, guide bars, link sides, shear blades, and thin castings, such as journal boxes which can be set up in multiple for light finish-machining operations.

An outstanding characteristic of the Mattison surface-grinder is the powerful built-in motor construction, with the rotor mounted directly on the wheel spindle and balanced as a unit. With this positive and direct form of drive, no vibration is imparted to the wheel spindle, as may be the case with belts, chains, gears or other drive connections.

To remove stock successfully with a grinding wheel it is necessary to maintain full power. When the wheel slows down, due to slippage, cutting efficiency is lowered



One of the Mattison high-power precision surface grinders of a size adapted to grinding locomotive guide bars

and capacity and quality suffer. On the Mattison machine, the motor delivers its full power direct to the wheel and there is ample reserve to insure full wheel speed for fast grinding.

The wheel spindle with its totally enclosed, built-in motor, is mounted in heavy housing which is carried on the horizontal ways of the wheel slide assembly. This wheel slide assembly is in turn supported between two substantial columns having large taper-gibbed ways. This design affords a strong and secure support for the working parts.

Longitudinal table travel is hydraulically operated. The stroke is adjustable to cover any portion of the table up to its maximum by a simple setting of the table reversing dogs. Table speed ranges from 30 ft. to 100 ft. per minute. The transverse feed of the wheel is also hydraulically operated, movement being entirely automatic when grinding. Feed is variable up to 1¾ in. at each reversal of the table. Both quick-acting and low-geared cross feeds, with automatic reversal, can also be operated by handwheel, either for grinding or wheel truing.

Operating and adjusting levers, handwheels and electric push buttons are closely concentrated on the front of the machine, all within convenient reach of the operator. Raising the wheel from the work is done electrically and the controlling push button is located in the end of the clutch lever. With one movement the hoisting motor is started and the power clutch is engaged. The downward movement of the wheel is controlled by a separate push button which is so arranged that the travel continues only while the operator keeps the button depressed. This permits spotting the wheel just above the work. Final adjustment for grinding is made by a handwheel and stop, with micrometer graduations of .0001 in. The reversing of the wheel slide traverse is accomplished automatically, both on hand and hydraulic feeds, by two dogs on a circular disk, easily adjustable and located directly in front of the operator. This mechanism also serves as a quick means for locating the wheel in the center of the work.

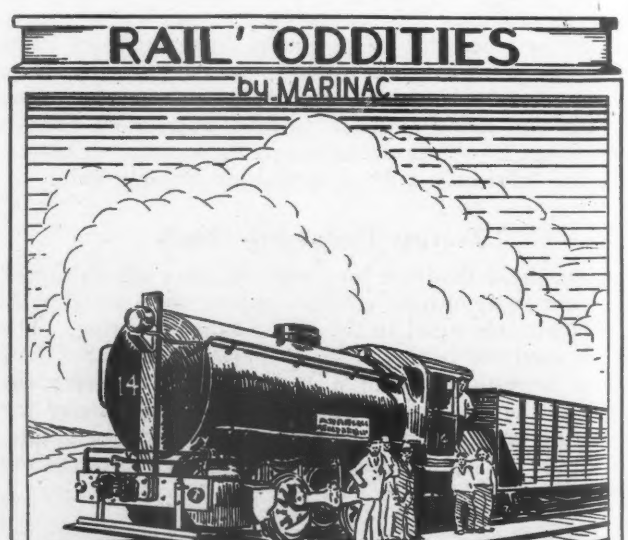
Increased production, together with savings in grinding costs, are direct results of the generous size of this Mattison surface grinder. Being able to fill the table or magnetic chuck with a large number of parts per set-up, together with a 6-in. face wheel increases capacity Work hitherto ground with narrow wheels on small, light machines, can be ground much faster and with greater accuracy on this high-powered Mattison surface-grinder.

Diesel Engine Questions and Answers

19. *Q.—In connection with Diesel engines what is the cause of excessive exhaust temperature and what causes low scavenging pressure? How does the condition of the valves affect this?* A.—The exhaust temperature will be affected by the completeness of combustion and the expansion following combustion. A low exhaust temperature is an indication that the heat of combustion has been more completely converted into power or absorbed by the circulating water in the jackets or pistons. If too much fuel is injected or combustion is late or delayed, the heat generated during the power stroke may not be fully converted into power and the exhaust gases will then contain more heat units than they should and this will be indicated by a higher than normal exhaust temperature. Also, if the exhaust opens too soon by reason of improper adjustment, this also would cause a higher exhaust temperature. Delayed combustion may be caused by faulty admission of the fuel and defective air mixture. Leaky fuel injection valves or improper adjustment may be the cause. Leaky piston rings also may have some effect, as this detracts from the ability of the piston to absorb the power from the expansion of the gases during the power stroke and will also cause some loss of compression. The exhaust-gas temperature will rise to some extent with increase in power as there is a greater amount of heat to be converted. However, at low power an extremely low exhaust temperature may not be an indication of efficiency but may be caused by an excess of jacket cooling which takes away some of the heat which should be converted into mechanical energy. Low scavenging pressure is most likely caused by defective or inadequate scavenging pumps. However, there is no particular gain in efficiency by having the scavenging pressure too high. This will increase the power, if enough fuel is injected. Leaky valve or other maladjustment of the scavenging pump, such as leaky pistons or other leaks, improper speed in case of a rotary blower and various other defects may account for a loss of pressure for the scavenging system. The remedy for above defects is to see that all parts are in proper adjustment and that the pistons, valves, etc., are kept tight.

20. *Q.—In a Diesel engine, what does smoky exhaust indicate?* A.—A smoky exhaust indicates that the engine is overloaded or the injection of fuel is not timed properly. This condition also may indicate that the oil may be of inferior quality.

* * *



For explanation see page 88.

Among the Clubs and Associations

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—The A. A. R. Rules of Interchange will be discussed at 8 p. m. on February 10 at the La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—The A. A. R. rules and their changes will be discussed at the February 13 meeting, which will be held at 1:15 p. m. at the Union Pacific shops, Council Bluffs, Iowa.

NEW ENGLAND RAILROAD CLUB.—E. K. Bloss, supervisor rail motor car maintenance of the Boston & Maine, will deliver a paper on Diesel engines at the February 11 meeting, which will be held at the Copley-Plaza Hotel, Boston, Mass., beginning with dinner at 6:30 p. m.

Directory

The following list gives names of secretaries, dates of next regular meetings and places of meetings of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, c/o Westinghouse Air Brake Company, 3400 Empire State Building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.

RAILROAD DIVISION.—Marion B. Richardson, 192 East Cedar street, Livingston, N. J.

MACHINE SHOP PRACTICE DIVISION.—G. F. Nordenholt, 330 West Forty-second street, New York.

MATERIALS HANDLING DIVISION. — F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

OIL AND GAS POWER DIVISION. — M. J. Reed, 2 West Forty-fifth street, New York.

FUELS DIVISION.—W. G. Christy, Department of Health Regulation, Court House, Jersey City, N. J.

ASSOCIATION OF AMERICAN RAILROADS. — J. M. Symes, vice-president operations and maintenance department, Transportation Building, Washington, D. C.

DIVISION I. — OPERATING. — SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

COMMITTEE ON RESEARCH.—E. B. Hall, chairman, care of Chicago & North Western, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION VIII.—MOTOR TRANSPORT.—CAR SERVICE DIVISION.—C. A. Buch, Transportation Building, Washington, D. C.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. —Jos. A. Andreucetti, C. & N. W., 1519 Daily News Building, 400 West Madison street, Chicago, Ill.

CANADIAN RAILWAY CLUB. — C. R. Crook, 2271 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month, except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, 7926 South Morgan st., Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—J. R. Leach, car department, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month at 1:15 p.m. at Union Pacific shops, Council Bluffs.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION. — E. L. Brown, care of the Baltimore & Ohio, St. George, Staten Island, N. Y. Regular meetings, fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION. — R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m.

INTERNATIONAL RAILWAY FUEL ASSOCIATION. — T. D. Smith, 1660 Old Colony Building, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 West Wabasha street, Winona, Minn.

INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

MASTER BOILERMAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, excepting June, July, August and September, at Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION. — E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Minnesota Transfer Y. M. C. A. Gymnasium Building, St. Paul.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately—June, in Los Angeles and October, in Sacramento.

RAILWAY CLUB OF GREENVILLE. — J. Howard Waite, 43 Chambers avenue, Greenville, Pa. Regular meetings, third Thursday in month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION. —J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, Association of American Railroads.

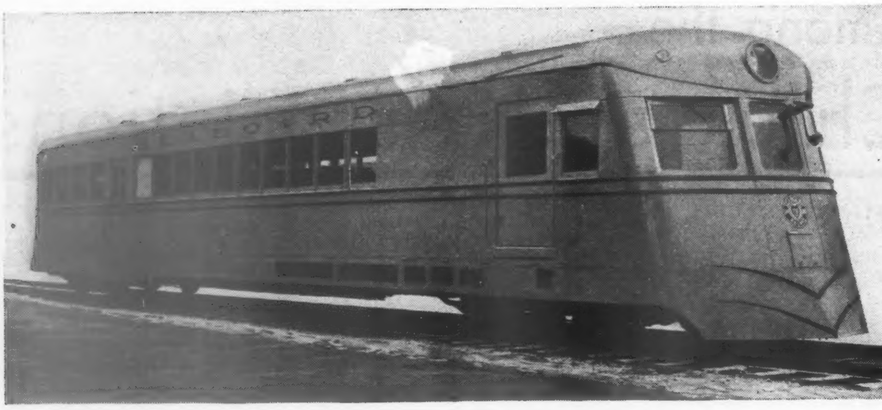
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—R. H. Burgess, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION.—J. M. Nicholson, president, Kansas City, Mo.

WESTERN RAILWAY CLUB.—C. L. Emerson, 822 Straus Building, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

EXHIBITION OF MODEL ENGINEERS.—The eighth annual exhibition of the New York Society of Model Engineers, Inc., will be held from February 7 to 22, inclusive, at the club rooms of the society on the third floor of the Knickerbocker Building, 152 West Forty-second street, New York. The exhibition will be open from 1 p. m. to 10:30 p. m. every weekday, and an admission fee of 25 cents will be charged. The illustration is representative of the society's model railroad layout. It shows a section of the ¾-in.-to-the-foot scale right-of-way of the road, which is known as the Union Connecting Railroad. Much of the 400 ft. of operating track of this model layout is main line.



One of three rail-motor cars built by the American Car and Foundry Company for the Seaboard Air Line

NEWS

Decorated Dining Cars

The Pennsylvania has just put in service a dining car the interior of which is decorated with the coats of arms of thirteen states and the District of Columbia—that is to say, the territory traversed by the company's lines. The car will be assigned to different trains for short periods, so that it may be displayed to all parts of this railroad company's public. These emblems have been painted by hand and appear in the panels between the windows and in the end panels. They are the symbols of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Kentucky, Ohio, Indiana, Michigan, Illinois, Missouri and the District of Columbia.

Chicago Chapter of Historical Society To Be Formed

Preliminary steps toward the organization of a Chicago chapter of the Railway and Locomotive Historical Society were taken at a recent meeting, when members residing in Illinois, Wisconsin and Indiana elected officers and applied to the national headquarters for a charter. Officers chosen for the Chicago chapter are: Chairman, Carlton J. Corliss, assistant in public relations of the Illinois Central; vice-chairman, A. W. Johnson; secretary, Delmar W. Youngmeyer; treasurer, A. Osterholm. The objectives of the society are historical research and the preservation of railway records of permanent interest. The headquarters of the society are in the Baker Library, Boston, Mass.

Burlington Orders Two More Zephyrs

Two more Zephyrs—"Denver Zephyrs" —have been ordered by the Chicago, Burlington & Quincy from the Edward G. Budd Manufacturing Company. They will be placed in service between Chicago and Denver, Colo., in June, on a schedule of 16 hr. for the 1,039 miles. The proposed schedule of the new trains is 11 hr. 45 min. faster than the present westbound, and 9 hr. 15 min. faster than the present eastbound schedules. The average running speed between Chicago and Denver will be approximately 65 m.p.h., including six or seven stops en route.

The train, which will have a capacity for 200 persons, will contain 10 cars, having an exterior width of 10 ft. The first car will probably be a combination baggage and power car, and the second car a combination passenger-baggage car. The remaining eight cars will include a reclining chair car, four sleeping cars, a club car, a dining car and an observation car. Each train will be hauled by a Diesel-electric locomotive in two vehicle units. Articulation will be applied between cars three, four and five; six and seven; and eight and nine. All other cars and the two locomotive units will have two trucks each.

With the inauguration of the Denver Zephyrs, the Burlington Zephyr mileage per day will total 4,784. This will include 2,078 miles between Chicago and Denver, 1,764 miles between Chicago and the Twin Cities, 441 miles between St. Louis, Mo., and Burlington, Iowa, and 500 miles between Lincoln, Neb., and Kansas City, Mo. The latter four Zephyrs, up to the beginning of 1936, had operated a total of 697,687 miles.

Purdue Dean to Head American Engineering Council

Dr. A. A. Potter, dean of the Schools of Engineering, Purdue University, has been unanimously nominated as president of the American Engineering Council for 1936 and 1937, to succeed J. F. Coleman, of New Orleans. Dean Potter is a past-president of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education, the Indiana Engineering Society and the Kansas Engineering Society, which are member bodies of the national Council.

Three Rail Motor Cars for Seaboard Air Line

The Seaboard Air Line has received from the Berwick plant of the American Car and Foundry Company three light-weight rail-motor cars, designed for single-unit operation. The cars weigh 52,000 lb. in working order and, including a revenue load of 57 passengers and 5,000 lb. of baggage, weigh 65,550 lb.

The overall length of the cars is 64 ft. 1 in., and the height from the rail to the top of the roof is 10 ft. 5 in. The maximum width over the side posts is 9 ft., and the inside height from floor to ceiling is 7 ft. The interior is divided into three compartments, one for baggage and two passenger compartments, one for white passengers and one for colored passengers. The cars are of streamline design with a well rounded front containing three large windows fitted with shatterproof plate glass. The rear end is of the beaver-tail type and contains two large windows.

The superstructure is of steel-frame construction with aluminum side sheets and letter boards, wood floors and a wood roof covered with Mulehide. The entrance vestibule is of the center type and is located between the two passenger compartments.

The power plant is mounted entirely beneath the floor. The engine is a six-cylinder horizontal Hall-Scott Model 180, developing 176 hp. at 2,200 r.p.m.

The car body is mounted on an A. C. F. Model 96-AM-2 drive truck at the front end and a Model 96-AT-2 trailing truck at the rear end. The brake rigging is of the outside-hung type on the drive truck and of the inside-hung type on the trailer.

The air-brake equipment is the Westinghouse semi-automatic type with mechanically driven compressor having an unloading device and with self-lapping hand-operated brake valve, with both hand and foot operated safety control. The brake cylinder for the front truck is of the body-hung type, and that for the trailing truck is mounted on the truck itself.

(Turn to next left-hand page)

Equipment Orders

Road	No. ordered	Type	Builder
Locomotives			
C., B. & Q.	3	4-8-4	Company shops
N. Y., N. H. & H.	5	660-hp. Diesel-elec. switchers	Cooper-Bessemer Corp.
	5	600-hp. Diesel-elec. switchers	Ingersoll-Rand Co.
S. A. L.	1	0-4-0 switch	Baldwin Locomotive Works
	6	16,000-gal. tenders	
Cars			
Bangor & Aroostook	50	50-ton rack	Magor Car Corp.
C., B. & Q.	500*	Box	Havelock Uebraska shops
	2†	10-car trains	Edw. G. Budd Mfg. Co.
	2‡	7-car Diesel-elec. trains	
Paulista Ry. of Brazil	400	45-ton, all-steel box	Pullman-Standard Car Exp. Corp.

* In addition to 500 being constructed at Galesburg, Ill., shops.
† Exclusive of motive power. The cars are to be of light-weight stainless steel.
‡ To consist of a dining car, a cocktail lounge, a parlor car, an observation car, and coaches; 10 ft. wide; stainless steel.

Personnel Changes in National Railroad Adjustment Board

L. O. Murdock, assistant to the executive vice-president of the Chicago, Burlington & Quincy, in charge of labor matters, has been appointed a member of Division 3 of the National Railroad Adjustment Board, to succeed E. W. Fowler, who has been transferred to Division 1, to replace Macy Nicholson, who has resigned.

R. A. Knoff, superintendent of the labor and wage board of the Central region of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been appointed a member of Division I of the Adjustment Board.

Supply Trade Notes

The Armco Railroad Sales Company, Middletown, Ohio, has moved its Philadelphia, Pa., office to the Lincoln-Liberty building, Broad and Chestnut streets.

Charles G. Durfee, manager, systems department of the Pyrene Manufacturing Company, Newark, N. J., has been appointed assistant to Edward G. Weed, vice-president in charge of sales.

David S. Wright, of the department of inspection and metallurgy of the Indiana Harbor works, Indiana, of the Inland Steel Company has been transferred to the sales department with headquarters at St. Paul, Minn.

The National Malleable and Steel Castings Company, Cleveland, Ohio, has moved its Philadelphia, Pa., office from 1600 Arch street to 1140 Broad Street Station, 1617 Pennsylvania Boulevard.

Thomas N. Armstrong, Jr., has joined the technical staff of The International Nickel Company, Inc., New York. Mr. Armstrong, who will handle the steel castings development for the company, will operate out of the New York office.

L. F. Sweeney has been appointed assistant to the vice-president of the Standard Stoker Company, Inc., Chicago, succeeding C. T. Hansen who has been appointed district sales manager to succeed R. J. Schlacks, resigned.

The DeVilbiss Company, Toledo, Ohio, training school for painters and others interested in learning the technique of spray-painting, and the use and care of spray-painting equipment, will be open for periods of one week beginning February 10, March 9, April 6, May 4 and June 8.

J. B. Spencer, vice-president of the Southern Wheel Company, a subsidiary of the American Brake Shoe & Foundry Company, has been elected president of the Ramapo Ajax Corporation, also a subsidiary of the American Brake Shoe Company. Mr. Spencer's headquarters are at New York.

The Markham Supply Company, Chicago, has been appointed general railway sales representative for the Chicago, St. Louis, Mo., Kansas City, Omaha, Neb., and Twin Cities territory for the Babcock & Wilcox Tube Company, Beaver Falls, Pa. Lloyd R. Wells, formerly railway sales representative of the latter company, will continue in the same capacity with the Markham Supply Company.

The United States Steel Corporation, New York, has created three additional vice-presidencies, and appointed to such offices the following: Harold L. Hughes, vice-president, with executive duties assigned by the president; W. A. Forbes, vice-president, with supervision over by-product coke plants and disposition of their products, and Charles H. Rhoades, vice-president, with supervision over purchases.

The Republic Steel Corporation has moved its general offices from Youngstown, Ohio, to the Republic Building, Cleveland, Ohio. The move consolidates the general offices which have been located in Youngstown, the executive and the Cleveland district sales offices in Cleveland and the advertising department at Massillon, Ohio. The sales offices of the Newton Steel Company will also be located in Cleveland. The sales offices of the alloy steel division of Republic will remain in Massillon, Ohio.

Obituary

William J. Piersen, western sales manager of the Adams & Westlake Company, Chicago, died at Evanston, Ill., on January 12.

Harry L. Horning, president and founder of the Waukesha Motor Company, Waukesha, Wisc., died at Battle Creek, Mich., on January 4.

Harry Daniels, manager of the railroad department of the West Disinfecting Company, died on January 19, at Evanston, Ill., of bronchial pneumonia.

J. Alfred Dixon, vice-president of the Safety Car Heating & Lighting Company and president of the Pintsch Compressing Company, New York, died on January 13. Mr. Dixon was born on May 26, 1867, at East Orange, N. J. He received his early education at the Ashland School in East Orange; he then attended Steven's Preparatory School and was graduated in 1891 from Steven's Institute of Technology, at Hoboken. Mr. Dixon entered the employ of the Safety Car Heating & Lighting Company immediately after his graduation and later was placed in charge of construction of Pintsch gas plants throughout the United States. He was subsequently made vice-president and general manager of the Pintsch Compressing Company and since 1919 had served as president of that company, which is a subsidiary of the Safety Car Heating & Lighting Company. He also had served since June, 1912, as a vice-president of the Safety Car Heating & Lighting Company. At the time of his death, Mr. Dixon was also a member of a number of technical associations and clubs.

Personal Mention

General

J. F. Johnson has been appointed inspector of tests of the Florida East Coast, with headquarters at St. Augustine, Fla.

H. N. Smith, master mechanic of the Canadian National at Saskatoon, Sask., has been appointed acting superintendent of motive power and car equipment.

C. S. Taylor, master mechanic of the Atlantic Coast Line at South Rocky Mount, N. C., has been appointed superintendent motive power, Northern Division, with headquarters at South Rocky Mount.

E. L. Bachman, master mechanic of the Pennsylvania, with headquarters at Harrisburg, Pa., has been appointed acting superintendent motive power of the Eastern and Central Pennsylvania division, succeeding H. H. Haupt.

W. S. Lammers, assistant mechanical valuation engineer of the Atchison, Topeka & Santa Fe, has been appointed mechanical valuation engineer, with headquarters as before at Topeka, Kan.

(*Turn to next left-hand page*)

Master Mechanics and Road Foremen

W. B. Middleton has been appointed master mechanic of the Atlantic Coast Line, with headquarters at South Rocky Mount, N. C.

George C. Jones, master mechanic of the Atlantic Coast Line at Jacksonville, Fla., has had his jurisdiction extended to include the Jacksonville district and Sanford, Fla., shops.

W. Alexander, locomotive foreman of the Canadian National at Transcona, Man., has been appointed acting master mechanic, with headquarters at Saskatoon, Sask., succeeding L. G. Robin, retired.

Shop and Enginehouse

R. M. Wilson has been appointed shop superintendent of the Erie, with headquarters at Hornell, N. Y.

A. B. McKinney, night foreman of the Canadian National at The Pas, Man., has been promoted to the position of locomotive foreman at The Pas.

M. Carroll, enginehouse foreman of the Atlantic Coast Line, has been promoted to the position of general foreman, with headquarters at Sanford, Fla.

Obituary

Leon M. Jones, who served as purchasing agent of the Norfolk Southern from 1913 until his retirement January 1, 1932, died at his home in Princess Anne County, near Norfolk, Va., on January 1, at the age of 66.

H. R. Stevens, master mechanic of the Atlantic Coast Line at Sanford, Fla., died on January 3. Mr. Stevens began his railroad career with the Central of New Jersey in 1882 as a machinist apprentice. In 1888 he became a machinist on the Erie, later becoming a gang foreman of the New York, Susquehanna & Western. He entered the employ of the Atlantic Coast Line in 1900 as a general foreman at Rocky Mount, N. C. On September 23, 1903, he was appointed master mechanic at Sanford.

Frank H. Adams, mechanical valuation engineer of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., died on January 6. Mr. Adams was born on April 15, 1866, at Woodville, Mass., and obtained his higher education at the University of Minnesota. He entered railway service in 1887 as a special apprentice on the St. Paul & Duluth (now part of the Northern Pacific). In 1891 he entered the service of the Gulf, Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe System) as chief draftsman, serving in this position until 1901, when he was appointed engineer of shop extensions of the Santa Fe. From 1914 to 1921, Mr. Adams served as senior mechanical engineer of the Bureau of Valuation of the Interstate Commerce Commission, Western district, with headquarters at Kansas City, Mo. Since 1921 he had held the position of mechanical valuation engineer of the Santa Fe at Topeka.

W. O. Thompson, who retired in 1930 as equipment assistant of the New York Central, died on January 5 at Cleveland, Ohio. Mr. Thompson was born at Candaque, Mich., in 1860, and entered railway service as a section laborer on the Fort Wayne, Jackson & Saginaw (now part of the New York Central). Mr. Thompson then served successively as an apprentice for the Michigan Central, as a fireman and locomotive engineman for the Fort Wayne, Jackson & Saginaw, as a traveling engineer and engine dispatcher for the Lake Shore & Michigan Southern (now part of the N. Y. C.), and as a master mechanic for the Toledo, St. Louis & Western (now part of the New York, Chicago & St. Louis), and in the following positions on the New York Central: General locomotive inspector, district superintendent motive power and rolling stock, master car builder, superintendent rolling stock, general superintendent rolling stock and equipment assistant. At the time of his death, Mr. Thompson was secretary of the Traveling Engineers' Association, president of the New York Central Railroad Mutual Relief Association, and first vice-president of the Central Railroad Men Savings & Loan Association.

W. O. Thompson

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

Boiler Tubes.—The Bethlehem Steel Company, Bethlehem, Pa., has issued a four-page folder, No. 338, descriptive of Bethlehem 4.5 boiler tubes.

Pipe Tools.—The four-page bulletin issued by Beaver Pipe Tools, Warren, Ohio, describes a new Model-A special pipe machine having a capacity to cut all sizes of pipe from ⅛ in. to 2 in.

Direct Reading Dials.—The Monarch direct length reading dial is described and illustrated on the catalog insert, Bulletin S-7, issued by the Monarch Machine Tool Company, Sidney, Ohio.

High Tensile Steel.—The average physical properties of Armco H.T.-50, a special high-tensile steel which permits the use of advanced methods of fabrication and welding processes, are tabulated in a four-page folder of useful facts issued by the American Rolling Mill Company, Middletown, Ohio. The steel is especially suitable for many types of railroad equipment.

Diesel Switching Locomotives.—An attractive 36-page, spiral-bound booklet describing Diesel electric locomotives for switching service has been issued by the American Locomotive Company, New York. Following an account of the company's entrance into the field of Diesel locomotive development, operating data on several different 600-hp. locomotives are given. The trucks and the Alco type Diesel railway engine and its parts are then described, and specifications and performance curves for 300-, 400-, 600- and 900-hp. switchers given. The illustrations show clearly many details of construction.

MARINAC'S RAIL ODDITIES

Marinac has furnished us with the following explanations of the three cartoons which appear elsewhere in this issue:

Page 57. The sixteenth century "Gold Mine Lorry" used in a Hungarian mine was still in service in 1890. The lorry, as well as the rails and wheels, is made of wood and is on exhibition at the Berlin Transport Museum—quite a step from our present-day electric mining cars.

Page 65. John D. Lamey, of Hoquiam, Wash., living near a railroad, was required to walk five miles to town each day. He decided that if the railroad would not furnish him with a train he would construct one for himself. The result was a composition of a bicycle frame, a few pieces of steel tubing, plus his inventive ingenuity and four papier mache wheels—and the one-man train was developed.

Page 84. The largest fireless switching locomotive ever built was for use at the Brooklyn Navy Yard. Containing no firebox it runs on stored steam. The huge tank, resembling the boiler of an ordinary locomotive, is periodically filled with steam from a stationary plant. Steam pressure of 200 lb. is built up at the time of charging, and the switcher will operate successfully until the pressure falls below 50 lb. This drop does not usually occur for several hours. The charging operation consumes about 20 min. less time, it is estimated, than is required for a conventional engine to take on coal and water and clean out the fire and ash pans.